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PTO/SB/18 (5-05)

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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE**PROVISIONAL APPLICATION FOR PATENT COVER SHEET**
This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).**INVENTOR(S)**

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031281 601520641**TITLE OF THE INVENTION (280 characters max)**

HEAD PROTECTOR

111803

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 Application Data Sheet. See 37 CFR 1.76**METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT (check one)** Applicant claims small entity status. See 37 CFR 1.27.FILING FEE
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The invention was made by an agency of the United States Government or under a contract with an agency of the
United States Government. No. Yes, the name of the U.S. Government agency and the Government contract number are: _____

Respectfully submitted,

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Date 11/18/03

REGISTRATION NO.
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28,168

Docket Number:

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Additional Page

PTO/SB/18 (8-00)

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PATENT APPLICATION SERIAL NO. _____

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Title of the InventionHEAD PROTECTORField of the Invention

The present invention relates to head protectors and protective armour, and in particular but not limited to head protectors and armour for protecting personnel against blasts from explosives and other ordinance.

Summary of the Invention

According to one aspect of the present invention, there is provided a helmet comprising a shell, a shield member and coupling means for coupling the shield member to the shell and permitting movement of said shield member relative to said shell, and shock absorption means coupled to said coupling means and arranged to permit movement of said shield member relative to said shell independently of said coupling means.

According to another aspect of the present invention, there is provided a helmet comprising a shell and a shield member coupled to said shell for movement between a first position and a second position relative to said shell, and a locking system for locking said shield member in at least one of said first and second positions and comprising a rotary cam mounted on said shell, an aperture formed in said shield member and an opening in the side of said aperture for receiving said cam into said aperture, said aperture permitting rotation of said cam when located in said aperture to a position which prevents movement of said cam from said aperture through said opening.

According to another aspect of the present invention, there is provided a helmet comprising a shell and

a shield member coupled to said shell for movement between a first position and a second position relative to said shell, and a locking system for locking said shield member in at least one of said first and second positions, and comprising

5 a lock for preventing movement of said shield member relative to said shell and a manually accessible, compressible member adapted to release said lock on depression thereof, thereby allowing said shield member to move from the respective first or second position.

10 According to another aspect of the present invention, there is provided protective armour comprising a layer of a plastic, transparent material, a plurality of layers of high performance material, said layers being bonded together to form a laminate, and securing means for

15 securing said laminate to said layer of plastic transparent material.

According to another aspect of the present invention, there is provided a visor for a helmet comprising a layer of plastic transparent material, a plurality of

20 layers of high performance material, said layers being bonded together to form a laminate and securing means for securing said laminate to a portion of the surface of said plastic transparent material.

According to another aspect of the present

25 invention, there is provided a process for forming protective armour comprising the steps of providing a layer of plastic transparent material, forming a laminate comprising a plurality of layers of high performance material and securing said laminate to said layer of plastic

30 transparent material.

According to another aspect of the present invention, there is provided a helmet comprising a shell, a

strap guide mounted on each side of the helmet in a position for supporting a strap for passing under the chin of a wearer, when in use, a strap which passes through and between each strap guide such that the portion of said strap 5 between said strap guides form a chin strap, a support member coupled to the rear of said shell to allow relative movement between said support member and said shell and for engaging a portion of the head or neck of a wearer, when in use, said strap extending from each strap guide to said 10 support member, and a pull member extending from a position between said support member and said strap guides and which is arranged to cause the length of said strap extending from said support member through said strap guides to shorten when said pull member is pulled.

15 According to another aspect of the present invention, there is provided a retention system for a helmet comprising first and second strap guides for mounting on each side of the helmet in a position for supporting a strap for passing under the chin of a wearer, when in use, a strap 20 which passes through and between each strap guide, the portion of said strap between said strap guides forming a chin strap, a support member for movably coupling to the rear of said helmet for engaging a portion of the head or neck of a wearer when in use, said strap extending from each 25 strap guide to said support member, and pull members extending from said support member and which are arranged to cause the length of said strap extending from said support member through said strap guides to shorten when said pull members are pulled.

30 According to another aspect of the present invention, there is provided a helmet comprising a shell, an electrically powered system for assisting a wearer, and a power controller for controlling the power delivered to said

system, wherein said power controller is releasably mounted to said shell.

According to another aspect of the present invention, there is provided a helmet comprising a shell, a 5 visor having a moisture reducing treatment on the surface thereof facing the interior of the shell, and electrically powered means for providing ventilation air to the interior of said helmet, said electrically powered means being mounted to said helmet.

10 According to another aspect of the present invention, there is provided a control unit for controlling an electrically powered system for a helmet, the control unit having securing means for releasably securing the control unit to a helmet.

15 Description of Embodiments

Examples of embodiments of the present invention will now be described with reference to the drawings.

Impact Absorbing Mounting

Figures 1 and 2 show a helmet according to an 20 embodiment of the present invention. In particular, Figure 1 shows a cross-sectional view through a portion of the helmet and Figure 2 shows a side view of the helmet.

Referring to Figures 1 and 2, a helmet 1 comprises a shell 3 and a shield member 5, which in this embodiment 25 comprises a visor disposed towards the front of the helmet (although in other embodiments, the shield member may comprise any other member for providing additional protection at another position about a wearer's head). The helmet further includes a coupler 7 for coupling the visor 5 30 to the shell 3 and which permits movement of the visor

relative to the shell. The helmet further includes a shock absorption member 9 which is coupled to the coupler 7 and arranged to permit movement of the visor 5 relative to the shell 3 independently of the coupler 7.

5 In this particular embodiment, the coupler 7 comprises a pin or bolt for pivotally coupling the visor to the shell and the shock absorption member 9 comprises a bush of resilient material at least partially surrounding the coupler 7.

10 In this embodiment, a mounting block 11 is positioned between the exterior of the shell 3 and the visor 5 and has a receptacle 13 in which the resilient bushing 9 is accommodated. The receptacle may extend from one side of the mounting to the other, as shown in Figure 1, or may 15 extend partially through the mounting block. In this embodiment, the pin 7 is advantageously used also as a securing means for securing the mounting block 11 to the shell, and passes through an aperture 15 formed in the shell. The pin has an enlarged portion 17 positioned on the 20 interior side of the shell which prevents the pin from being drawn through the aperture 15. The other end 19 of the pin includes a threaded portion 21 for receiving a nut 23 to secure the mounting and visor assembly to the shell.

In this embodiment, and as shown in particular in 25 Figure 2, the shock absorption member 9 is arranged to permit movement of the visor 5 in a direction towards the interior of the helmet or towards the rear of the helmet as indicated by the arrows 25, 27 in Figure 2. In this embodiment, the shock absorption member 9 also allows 30 movement of the visor in all directions transverse to the pivot axis 29, shown in Figure 1 as it completely surrounds the pin. However, in other embodiment, the shock absorbing

mounting may limit relative movement between the visor and shell to one direction or a limited range of directions.

Advantageously, the shock absorbing mounting system provides some mechanical decoupling of the visor or 5 other shield member from the helmet shell, thereby reducing transmission of shock or transient forces from the visor or shield member to the shell. This may be advantageous in reducing rearward acceleration of the shell and therefore of the head of the helmet user when exposed to shock waves from 10 a blast or explosion to the front of the helmet, and to reduce the risk of head trauma or concussion.

In other embodiments, the mounting block 11 may be omitted and the visor connected to the shell via a coupling and impact absorbing arrangement which is disposed either 15 between the coupling and the shell or the coupling and the visor.

In another embodiment, a shock absorption arrangement, for example, a resilient member may be placed between the pin or bolt 7 and the visor 5, for example so 20 that the shock absorption system is carried on the visor, rather than or in addition to a mounting block and/or the shell.

Generally, the shock absorption means serves to allow movement of the visor relative to the shell and limits 25 the rate of relative movement or displacement, and may comprise any suitable element or arrangement of elements.

In another embodiment, the visor or other shield member may be slidably mounted to the helmet shell and a shock absorption element or system may be arranged between 30 the slidable mounting and the shell and/or between the visor and the slidable mounting.

Locking Mechanism

Figure 3 shows a helmet according to another embodiment of the present invention. The helmet 31 comprises a shell 33 and a visor 35 which is pivotally coupled to the shell by means of a hinge or pivot 37 to allow the visor to be raised and lowered. A locking mechanism 39 is provided to enable the visor to be locked in at least one of the lowered position and the raised position. An embodiment of a locking system is shown in more detail in Figures 4 and 5. The locking system 39 comprises a rotary cam 41 which is rotatably mounted to the shell 31, and a manually accessible knob 43, which allows the cam 41 to be rotated by hand. In this embodiment, a cam mounting block 45 is provided for mounting the cam 41 to the helmet shell and which may include any suitable arrangement for rotatably supporting and retaining the cam. The visor 35 has first and second apertures 49, 51 formed therein, each having an opening 53, 55 formed in the side of the aperture to allow the cam 41 to be received within the aperture. The apertures 49, 51 are shaped and sized to allow the cam 41 to rotate within the aperture to a position which prevents movement of the cam from the aperture through the opening, thereby locking the visor in a fixed position with respect to the helmet shell.

In this particular embodiment, the cam comprises an elongate member whose width is sufficiently small to allow the cam to pass through the opening into the aperture. In other embodiments, the cam may have any other suitable form and may, for example, comprise a discrete protrusion which is spaced radially (i.e. positioned eccentrically) with respect to the cam axis 57.

Advantageously, the provision of a cam locking system allows the visor to be locked and unlocked quickly (i.e. by requiring only a fraction of a revolution thereof between locking and unlocking) in comparison to other 5 locking mechanisms which require multiple rotations of a locking screw. Advantageously, the cam system also allows the width or profile "w" of the mounting block to be considerably reduced in comparison to locking mechanisms which use a screw-down system, where the mounting block 10 needs to be sufficiently deep to accommodate additional thread to allow the screw lock to fully clear the visor.

Figures 6A to 6D show another embodiment of a locking mechanism for locking a visor to a helmet shell. In particular, Figure 6A shows a top view of the locking 15 system, Figure 6B shows a plan view of the locking system, Figure 6C shows a cross-section through the locking system and Figure 6D shows a perspective view of the locking system. The locking system shown in Figures 6A to 6D may be incorporated in any helmet disclosed herein, as well as 20 others, and may for example replace the locking mechanism described above with reference to Figures 3 to 5. Referring in particular to Figure 6C, the locking system 71 comprises a lock 73 for preventing movement of a visor relative to a helmet shell, and a manually accessible, depressible member 25 75 which is adapted to release the lock on depression thereof to release the visor from the locked position. In one embodiment, the locking system comprises a mounting block 77 which conveniently accommodates components of the lock assembly and has a mounting face 79 for mounting 30 against a helmet shell (not shown). The mounting block includes a recess 81 for accommodating the lock 73. A bias 83 is provided for urging the lock 73 out of the recess 79 and which may comprise a bias spring located within the

recess 81. The locking system further includes a mounting member 85 which is fixedly mounted to the mounting block 77 and has an aperture 86 formed therein for receiving the depressible member (e.g. button) 75. The mounting member 85 5 serves to retain the movable member or lock 73 at least partially within the recess 79 when the button is released and guides reciprocal movement of the button 75 and the lock 73. In use, a visor 35 is positioned between the mounting member 85 and the mounting block 77 and has at least one 10 aperture formed therein, for example, aperture 227, 229 of embodiments of the visor shown in Figures 10 and 11, and which correspond to the positions in which the visor is to be locked. The apertures include an opening 231, 233 (Figures 10 and 11) in the side thereof which is 15 sufficiently large to accommodate the diameter of the button shaft 87 but which is smaller than the diameter or width of the locking member 73.

In operation, depression of the button 75 moves the locking member 73 into the recess 81, allowing the 20 button shaft 87 to pass through the opening of the visor aperture (Figure 10 and 11), thereby releasing the visor from the locked position so that the visor can be raised or lowered, as required. Once the visor assumes a position in which the visor can be locked with respect to the shell, 25 release of the button allows the locking member 73 to move into the visor aperture under the force of the biasing spring, thereby locking the visor in place. Advantageously, the visor may be arranged to engage the shoulder 89 of the locking member 73 once the locking member, in its retracted 30 position, is no longer aligned with a visor aperture so that the button 75 remains depressed until the visor assumes a second locking position or re-assumes the original locking position in which a visor aperture becomes aligned with the

locking member. This arrangement allows the visor to be moved into a locking position without the need to depress the button a second time or to continually depress the button when moving the visor from one locking position to 5 another position.

Advantageously, the locking arrangements according to embodiments of the present invention allow the visor to be unlocked, moved and relocked with one hand, and reduce the width or profile of any mounting block that may be used.

10 In the embodiment of Figures 6A to 6D, the mounting block 77 also includes a mounting for pivotally mounting the visor to a helmet shell. Advantageously, the pivotal mounting may include shock absorption means between the mounting 77 and the visor 35 to reduce the transmission 15 of shock from the visor to the mounting and subsequently to the helmet shell, or vice versa, as for example, described above with reference to Figure 1 and 2.

In one embodiment, the mounting assembly may 20 optionally include a clip 91 for holding a light source e.g. torch or flashlight (not shown) or other device such as a camera or microphone.

Protective Armour

Figure 7 shows a protective armour construction according to an embodiment of the present invention, and 25 which may be used, for example, in the construction of a visor for a helmet. Referring to Figure 7, the protective armour 101 comprises a first substrate 103 comprising a transparent plastic material, and a second substrate 105 comprising a plurality of layers 107 of high performance 30 material which are laminated together. Each layer of high performance material may comprise a material having a high

tensile strength transverse to its thickness, t , examples of which may include but are not limited to a high performance fabric, either woven or non-woven, for example Spectra®, Dyneema®, Kevlar®, as well as others. Each layer 107 may 5 comprise a composite of high performance material and thermo-plastic resin. The second substrate or laminate 105 may be formed by applying at least one of pressure and heat to the plurality of layers when in contact with one another to cause the thermo-plastic resin in each layer to bond with 10 an adjacent layer.

The second substrate 105 is secured to the first substrate 103 by any suitable means, for example, by adhesive or by one or more mechanical elements or agents, such as bolts, rivets, screws or other mechanical means.

15 In one embodiment, the second substrate may be secured to the first substrate by means of urethane. The inventors have found that urethane can provide an exceptionally strong and uniform bond between the laminate and transparent plastic substrate 103. The bonding process 20 may be performed by placing a sheet or layer of urethane between the first and second substrates and applying heat to the urethane sheet, for example, sufficient to cause melting of the urethane sheet. Advantageously, the melting point of urethane is relatively low and will generally be below that 25 of the first and second substrates. Pressure may also be applied between the first and second substrates to maintain the urethane sheet in intimate contact therewith during the bonding process.

The first substrate may comprise polycarbonate or 30 acrylic or another similar material. In other embodiments, any other suitable adhesive may be used to bond the first

and second substrates together and which may or may not be provided in sheet form.

The combination of a transparent plastic material and laminate provides a protective construction which can be
5 thinner than a construction formed of layers of transparent plastic material alone, (e.g. acrylic or polycarbonate) and yet provide a similar level of protection.

Figures 8 to 11 show various views of a visor for a helmet which employs in its construction an embodiment of
10 the protective armour described above.

Referring to Figures 8 to 11, the visor 201 comprises a substrate 203 formed of a plastic transparent material, for example, polycarbonate, and a second substrate 205 comprising a plurality of layers of high performance
15 composite material. As shown in Figures 9 to 11, the second substrate 205, which is generally opaque, is secured over a portion of the first substrate 203, and in the present embodiment defines a window 209 for permitting light to pass therethrough.

20 The visor also includes a further substrate 211 positioned over the front surface of the first substrate 203. The additional substrate 211 comprises a transparent material and may, for example, comprise acrylic or polycarbonate. The additional substrate may be secured to
25 the first and/or second substrates using any suitable means, for example, rivets 213, 215 or other mechanical means, or by adhesive. A spacer 217 may be provided between the first and additional substrates 203, 211 to prevent direct contact between them.

30 In a specific embodiment, the first substrate 203 comprises polycarbonate and the additional substrate 211

comprises acrylic. The additional substrate 211 extends over a limited portion of the first substrate 203, and in particular over an area opposite the viewing window 209, and serves to enhance the level of protection of the transparent area of the visor. In particular, acrylic, which is harder than polycarbonate, presents a hard strike face to explosive fragments, causing the fragments to slow rapidly and break into smaller parts. The use of the combination of a layer of polycarbonate and laminate of high performance material allows the amount of acrylic, which is heavier than polycarbonate, used in the construction of the visor, to be considerably reduced, and in particular eliminates the need to use acrylic over the entire exterior surface or strike face of the visor. In the present embodiment, the use of acrylic is limited substantially to the transparent area of the visor resulting in a lighter construction. At the same time, the combination of a layer of polycarbonate (or other transparent plastic material) and a laminate of high performance material allows the thickness of the visor construction to be reduced, which in turn allows the forward extension of the visor also to be reduced. This assists in moving the center of gravity of the helmet rearwards for better balance.

Although in the embodiment shown in Figures 8 to 11, the second substrate 205 is placed behind the first substrate, in other embodiments, this order may be reversed so that the second substrate is placed in front of the first substrate.

Advantageously, embodiments of the visor whose construction employs the first and second substrate combination described herein significantly reduces the weight of the visor in comparison to known visor constructions, thereby resulting in a lighter helmet,

reduced weight towards the front of the helmet for improved balance and a reduced moment about the center of the helmet which tends to tilt the helmet forward.

The protective armour construction described and 5 defined herein may be used in the construction of protective armour for protecting any other part of the body.

Helmet Retention System

Figures 12 to 16 show examples of embodiments of a helmet retention system. Referring to Figures 12 to 16, a 10 helmet retention system 301 comprises first and second strap guides 303, 305 for mounting on each side of a helmet in a position for supporting a strap which passes under the chin of a wearer. The retention system includes a strap 307 which passes through and between each strap guide 303, 305, 15 the portion of the strap between the strap guides forming a chin strap 309. The retention system further includes a support member 311 for coupling to the rear of a helmet and for engaging a portion of the head or neck of a wearer, when in use. In this embodiment, the support member includes 20 flexible members 313, 315 for movably coupling the support member 311 to a helmet. The strap 307 extends rearwardly towards the support member 311, and the retention system includes two pull members 317 (only one of which is shown in Figures 12 to 14) which extend from the support member 311 25 and which are arranged to cause the length of the strap 307 extending from the support member, 311 through the strap guides 303, 305 to shorten on pulling the pull members 317. A toggle 319 or other member or feature may be provided on one or both pull members to allow the pull members to be 30 gripped more easily.

In the present embodiment, the pull members are part of the strap 307 and the retention system comprises

additional strap guides 321 which are connected to the support member 311. Each strap guide 321 comprises a cylindrical guide member 323 and a bar member 325 extending from the cylindrical guide member and forming an aperture 5 along its length. Each strap passes around the cylindrical member and through the aperture, thereby causing the strap to change direction and allowing the length of the strap which extends from the additional guides 321 and through the first and second guides 303, 305 to be shortened by pulling 10 on the portion of the strap, which extends beyond the other side of the additional strap guides, in a direction towards the front of the retention system. In use, this single action both tightens the chin strap around the chin of the helmet wearer and tightens the support member against the 15 back of the head or neck at the same time, considerably reducing the number of steps required to secure the helmet in position in comparison to other retention arrangements which require individual adjustment of the chin and nape supports.

20 Referring to Figures 12 to 16, the bar member 325 is mounted on the cylindrical member in such a way that the spacing between the bar member and the cylindrical member closes on pulling the strap, thereby squeezing the strap between the bar member and the cylindrical member. On 25 releasing the strap, friction between the strap and guide member prevents the strap slipping back through the guide member so that tension in the portion of the strap between the additional strap guides and the first and second strap guides 303, 305 can be maintained. The cylindrical member 30 may have a high friction surface provided, for example, by surface structure and in one embodiment, may have a knurled surface.

A release mechanism may be provided to unlock the strap guides 321. In this embodiment, the strap can be released by pulling on the bar member 325 to increase the gap between the bar member and guide member and unclamp the strap. A pull-tab 326 which extends from the bar member 325 may be provided to facilitate pulling on the bar member and releasing the strap. The pull-tab 326 may have a different shape or feature to the pull-member 317 to provide a tactile or visual difference between them so that a user can easily differentiate one from the other.

A connector may be provided for releasably connecting one portion of the strap to another portion of the strap and which is positioned within the length of the strap which extends from the support member through the strap guides 303, 305. In the embodiment shown in Figure 12, a strap connector 327 is provided in the portion of the strap between the first and second strap guides 303, 305, and is positioned to one side, so that, in use, the connector is positioned to the side of the face, rather than under the chin. This positioning is possibly more convenient for both access and comfort. Advantageously, this embodiment thus provides two independent release mechanisms to allow a helmet to be removed. The connector 327 may comprise a quick release connector to facilitate removal of the helmet in an emergency, or simply for convenience. In the embodiment shown in Figure 12, a chin pad 330 is provided for additional comfort. In this embodiment, the chin pad is sized to extend above the jaw and is positioned behind the connector 327 in order to prevent direct contact between the connector and the face, again for increased comfort.

Figure 13 shows another embodiment of a retention system which includes two separate chin pads 329, 331 each

being slidably mounted on the strap 307 so that its position can be adjusted to suit an individual user.

Figure 14 shows another embodiment of a retention system which also includes two adjustable chin pads 329, 5 331, and a connector 327 positioned therebetween, so that in use, the connector is positioned under the chin. Figures 15 and 16 show part of a helmet retention system in more detail, and in particular, Figure 15 shows a rear view of a support member and associated strap guide assembly and 10 Figure 16 shows a top view of the embodiment shown in Figure 15.

Figures 15 and 16 illustrate an embodiment of each of the additional strap guides in more detail, and which may be used as the additional strap guides in the embodiments of 15 Figures 12 to 14. Each strap guide comprises a roller or knurled buckle having a substantially rectangular ring 324 and a cylindrical member 323 slidably received on two arms of the ring via through holes. One side of the ring is secured to the support member 311 and the other side 325 20 provides a bar member which, with the cylindrical member provides a clamp for clamping the strap 307 when the strap is pulled and the cylindrical member 323 is thereby urged towards the bar member. To release the clamp, the bar member is simply swung away from the support member 311, as 25 for example, shown in Figure 16, which causes the cylindrical member to slide away from the bar member 325 expanding the gap therebetween and releasing the strap 307.

In this embodiment, a clip 343, 345 is provided on each flexible member 313, 315 to facilitate mounting and 30 removal of the helmet retention system to and from a helmet. In this particular embodiment, each clip has a T-hole for

registration with a corresponding T-screw mounted on the helmet.

Advantageously, the chin strap may be arranged to be worn under the chin or jaw and away from the front of the 5 chin, to allow the helmet to be worn with a respiratory device such as a gas mask.

Helmet Control Unit

Figures 17 and 18 each show a perspective view of a helmet according to another embodiment of the present 10 invention. Referring to Figures 17 and 18, the helmet 401 comprises a shell 403 and a control unit 410. The helmet further includes an electrically powered system for assisting a wearer which may be positioned at the control unit, at other parts of the helmet, or both. The control 15 unit 410 may be arranged to control functions of the electrically powered system and which may include, for example, controlling the power delivered to the system. The controller may include a monitoring system for monitoring a condition or function of the electrically powered system and 20 may provide an output indicative thereof.

Advantageously, the control unit is releasably mounted to the helmet shell to allow the control unit to be removed. This allows a faulty control unit to be readily replaced and the helmet returned to a serviceable condition 25 in the field, rather than having to return the entire helmet to a service center for repair, in which case the helmet could be de-commissioned for some considerable time. In one embodiment, the control unit may be slidably mounted to the shell by any suitable means, and may include a retention and 30 slid able guide system 412. The control system may include one or more electrical input/output terminals which connect

with corresponding electrical input/output terminals 414 mounted on the helmet shell.

In one embodiment, the control unit includes one or more electrically powered fans or other impellers 416, 5 418 for providing ventilation air to the interior of the helmet, for example, through ventilation ports 420, 422. The helmet may include a microphone and/or speaker system (not shown) and a visor 405. In a particularly advantageous embodiment, the interior surface of the visor may be treated 10 with a moisture or condensation reducing agent which reduces or completely removes the need for ventilation air to prevent condensation on the interior surface of the visor. This reduces the amount (e.g. CFM) of ventilation air required by the helmet, thereby reducing power consumption 15 and allowing the electrical power source (e.g. motor) to be smaller in comparison to existing systems. Reduction in the requirement for ventilation air also allows a quieter motor to be used so that the motor can be mounted close to the helmet shell without causing significant noise and 20 interference with audio equipment.

The helmet may include an indicator for indicating a condition or function monitored by the control unit, and the indicator may, for example, comprise an audio indicator, a visual indicator or a tactile indicator or any combination 25 of these. One or more indicators may be included on the control unit and/or on other parts of the helmet.

Other perspective views of the helmet of Figures 17 and 18 are shown in Figures 19 to 21, and the helmet may include any one or more further features disclosed herein.

Multi-functional Head Protector

In one embodiment, the head protector may include a helmet adapted for use with a number of interchangeable visors, each having a different function to increase the versatility of the system, and reduce costs by requiring only a single helmet. The visors may include one of the types described above for protection against explosive ordinance, a second visor having a relatively large transparent area for search and recognition and a third visor adapted to accommodate a respirator for use against chemical, biological or nuclear threats. An example of these visors are shown in Figures 22a, 22b and 22c.

Figure 22a shows an EOD visor mounted to the helmet, Figure 22b shows a search and recognition visor mounted to the helmet and Figure 22c shows an NBC visor mounted to the helmet. The EOD visor may be similar to that described above. The search visor 509 has a relatively large transparent area (eg of polycarbonate) to provide the user with a large field of view. In one embodiment, at least one of the visors includes a light source 511 which may be mounted on or adjacent the upper edge thereof (or at any other suitable location on the visor) to allow the wearer to search in dark or poor light conditions without the need for a hand-held flashlight. An example of a light source is described below.

The NBC visor 515 includes a transparent screen 517 and a shaped protective portion 519 below the screen for accommodating a respirator (i.e. gas mask). The transparent screen 517 may comprise any suitable material, including polycarbonate and/or acrylic, and in one embodiment, the lower portion 519 comprises a laminate formed of ballistic resistant fabric. Advantageously, this allows the lower

protective portion to be formed into any desired shape including relatively angular shapes which would be more difficult to form using a single layer of polycarbonate or acrylic.

5 In the present embodiment, the visor includes a substrate 521 formed of polycarbonate towards the inside of the visor and which accommodates the coupling for coupling to the helmet and the transparent screen 517. The visor includes a second substrate formed of laminated ballistic

10 resistant fabric secured to the first substrate and which forms a frame around the transparent screen and includes the respirator housing 519. A further layer of transparent material, for example acrylic or polycarbonate is placed over the transparent screen formed by the first substrate

15 for additional protection. In one embodiment, the respirator housing is sized and shaped so as to accommodate a wide variety of different respirators. Each visor may be mountable to the helmet using the same coupling mechanism. The coupling mechanism may be adapted to allow the

20 interchangeable visors to be manually releasable and preferably by a mechanism which is both accessible and operable externally of the helmet so that visors can be removed and replaced while the helmet is being worn. In one embodiment, the mechanism may allow the visor to be removed

25 by a simple sliding action and automatically retained on the helmet when the visor is rotated relative to the helmet to a position of use. An example of a coupling mechanism will now be described with reference to Figure 23.

Visor Coupling

30 Figures 23a to 23e show a visor coupling for releasably connecting a visor to a helmet. The coupling comprises a mounting plate 551 connected to the side of a

helmet shell 553 by any suitable means, and having a boss 555 extending therefrom for pivotally mounting a visor about an axis 557. A resilient member 559 may be provided about at least a portion of the boss 555 to allow a degree of 5 radial movement between the visor and the boss for impact absorption between the visor and helmet. The mounting plate further includes first and second protrusions (or lugs) 563, 565 extending therefrom positioned either side of the boss 555. The coupling further includes an outer plate 567 10 spaced from the mounting plate 551 to form a gap 569 therebetween for receiving a portion of the visor. Alternatively or in addition, lugs may extend from the outer plate 567.

15 The coupling further includes an open ended slot 571 formed in the side portion 573 of the visor and which terminates at a bearing edge 575 which bears against the resilient portion 559 of the boss 555 when the side portion 573 of the visor is inserted into the gap 569 between the mounting plate 551 and the outer plate 567.

20 The coupling further includes second and third slots 577, 579 formed in the side portion 573 of the visor for receiving the first and second protrusions 563, 565 and which together retain the visor on the helmet as the visor is rotated relative to the helmet about the axis 557.

25 To mount the visor to the helmet, the visor is oriented and positioned above the helmet so that the open ended slot 571 is aligned with the first and second protrusions 563, 565 and the boss 555, as shown in Figure 23a. The visor is then lowered into the gap 569 between the 30 mounting 551 and the outer plate 567 in the direction of arrow A (Figure 23a) so that the protrusions 563, 565 and the boss pass through the open ended slot 571 until the

bearing edge 575 engages the resilient portion of the boss 559. The visor may then be rotated forwarded as indicated by arrow B (Figure 23a) into an operable position. Forward rotation of the visor causes the first and second 5 protrusions to pass into and travel in the second and third slots 577, 575 to retain the visor on the helmet.

A locking mechanism (for example as described above and shown in Figures 6a to 6d) may be provided so that the visor can be locked in both an open position above the 10 helmet and in a lowered position. As the visor is rotated from its lowered position to its raised position, the locking mechanism may be arranged to automatically lock the visor in its raised position and this locked, raised position may advantageously be forward of the position at 15 which the slot is oriented such that the visor can be lifted and disconnected from the helmet. In this case, to remove the visor from the helmet, the visor has to be rotated rearwardly of its locked raised position.

In other embodiments, the visor retention means may comprise 20 any other suitable mechanism and in one embodiment, the protrusions may be removed and the retention means may be provided by the boss having a specially shaped surface which can pass through the slot in one orientation but not in other orientations so that the visor is rotatably retained 25 on the helmet.

In other embodiments, the retention means may comprise only one, or more than two protrusions and these may either be provided on the mounting plate or on the interior side of the outer plate.

30 A similar coupling mechanism may be provided on both sides of the visor and helmet, and a locking mechanism may be provided on only one side or on both sides.

Retention System

Figures 24a and 24b show another embodiment of a retention system for a helmet, which in certain respects is 5 similar to the retention systems shown in Figures 12 to 16 and described above but also with some significant differences. In particular the retention system includes a connector 351, 353 either side thereof for releasably connecting either a chin cup 355 or an under-the-jaw strap 10 357. Advantageously, this allows a chin cup or an under-the-jaw strap to be used with the retention system as desired, or required by the wearer. Furthermore, as a chin cup cannot be used with a respirator or gas mask, this arrangement allows the chin cup to be replaced with an 15 under-the-jaw strap when a respirator is used. The connectors in this particular embodiment are miniature seatbelt-type buckles and the male connector may be either on the retention system or the chin cup or strap and the female on the other, or vice versa.

20 Another important difference between the retention system shown in Figures 24a and 24b and that described above in conjunction with Figures 12 to 14, is concerned with the nape support 361, as best shown in Figure 24c. In the present embodiment, the straps 363, 365 which join the nape 25 support 361 to the back of a helmet extend from the nape support at an angle (rather than substantially vertically) and are directed and may meet at a common region 367. The adjustable straps 369, 371 extend from the nape support 361 downwardly at an angle (rather than horizontally) and are 30 also directed towards and may meet at the common region 367. The inventors have found that this arrangement in which the support and adjustable straps are directed towards a common

region of the nape support prevents bunching or buckling of the nape support when the adjustable straps are pulled tight to secure the helmet on a wearer's head. Furthermore, the downward angle of the adjustable straps makes it possible to 5 pull the adjustable straps forward and downwards, rather than requiring the straps to be pulled sideways as the former motion requires less effort and is more natural.

In the present embodiment, the adjustable straps 371, 369 pass from the nape support 361 to a lower portion 10 of the retainer 373 and then upwards to a connector or securing means 375 for securing the retainer at the side or front portion of a helmet. In this embodiment, the lower portion includes a slip ring 377 which is coupled to the chin cup or strap connector 351.

15 In this embodiment, the retainer also includes side supports or pads 381, 383 which, in use, are placed against side portions of a user's head or face for additional comfort and also provide additional surface area over which the retainer is secured to a person. The side pads 381, 383 20 also keep the upwardly extending portion 370 of the adjustable straps away from a wearer for additional comfort. The side supports may optionally include a speaker 391, 393 for audio communication.

Comfort Liner

25 Embodiments of the head protector may be provided with an adjustable comfort liner within the head cavity of the helmet to allow the size of the head cavity to be adjusted to fit personnel with different sized and/or shaped heads. Advantageously, this allows the helmet shell (and 30 other components of the head protector) to be manufactured in one size only, thereby reducing production costs. The comfort liner may be removable from the head cavity so that

it can be washed or cleaned or transferred for use with another helmet. An embodiment of a comfort liner is shown in Figures 25a and 25b.

Referring to Figure 25a, a comfort liner 601 for a 5 helmet has the form of a cup having a side wall 603, a lower circumferential edge 605 and an upper, crown portion 607 attached to the upper end 609 of the side wall 603. A plurality of retainers 610, 612, 614, 616, 618 are provided about the side wall 603, and in this embodiment, the 10 retainers are provided on the side of the wall which lies internally of the helmet head cavity and shall therefore be referred to as the internal wall of the liner. However, in other embodiments, one or more retainer may be disposed about the exterior wall 620 of the liner which faces towards 15 a users head.

In the side wall of the liner may comprise any suitable material and preferable comprises a cushioning material. The side wall has fluted, panel-shaped portions extending from an upper portion to a lower portion thereof, 20 and which may be formed by stitching 627 (as shown by the dashed lines). The retainers may be formed by a band of material extending about the interior wall of the liner, spaced portions of the band being attached to the liner to form a pocket 631 there between. Advantageously, the band 25 may be secured to the liner by the same stitching which provides the fluted panels 623, 625.

To adjust the size of the head cavity within the liner, packing inserts may be provided and inserted into the 30 retainers 612, 614 at selected positions about the liner so that the size and shape of head cavity is achieved to best fit a particular individual. The inserts may be formed of any suitable material, preferably a resilient material such

as a suitable foam. The retainers may also be made of any suitable material, including a resilient material such as foam. The liner may be formed of a fire resistant material in order to meet required safety standards.

5 To secure the insert to the helmet, in one embodiment, use is made of an impact absorption insert placed between the liner and the helmet shell. Referring to Figure 25b, a band of material 641 is placed over an impact absorption insert 643 and fits tightly therewith about the
10 lower portion of the insert. As the insert becomes wider towards its lower edge, the retaining band tightens against the insert as the band is pulled towards the edge so that the band cannot easily be pulled off from the edge, if at all. The retaining band contains connection means for
15 connecting the liner to the band, which in one embodiment may comprise a zipper. In the embodiment shown in 25b, one side of a zipper 645 (or zippers) is secured to the retaining band 641 and the other side of the zipper 645 is attached to the liner, as shown in Figure 25a. During the
20 production process, the retaining band 641 is secured in place over the impact absorption insert 643 and the combination is then inserted into the helmet shell.

In other embodiments, the packing retainers may be formed by any other suitable means and may extend about the
25 entire liner or only a portion or portions thereof.

The crown portion 607 may also be provided with one or more retainers for retaining packing material to allow the height of the head cavity to be adjusted to suit an individual wearer.

Light Source

Embodiments of the head protector may include a light source which is secured to a front portion of the helmet or visor. Figure 26 shows a front view of a head 5 protector 701 having a helmet 703 and a visor 705 and a light source 707 which is mounted on the visor and positioned at a middle portion of its upper edge. The light source may comprise an LED based light source, preferably having a high efficiency. The light source may include a 10 reflector and lens for concentrating the light into a beam having a desired shape and width. In the embodiment shown in Figure 26, the light source comprises two individual light sources 709, 710 which are spaced apart laterally. Each light source may be arranged to produce a beam and the 15 beams may be directed at any desired angle relative to each other and may converge or diverge as required. Each light source may comprise a light emitting diode and may further include a reflector and/or lens to produce the required beam. The light source may be powered by a DC source, for 20 example a battery power pack which may be mounted on the helmet or elsewhere on the wearer.

Base Control Module and Remote Control Module

Embodiments of the head protector may include base control module mounted to the helmet for controlling 25 electrical functions associated with the head protector. The head protector may include alternatively or in addition, a remote controlled module for controlling electrical functions associated with the head protector, which in use, may be mounted remotely from the head protector, for example 30 on an arm, leg or torso portion of a wearer. If both modules are provided, both may be arranged to control at least one electrical function which is the same so that if

one control module fails, the particular function (or functions) may still be controlled by the other control module. Advantageously, the remote control module may include a panel which is intended to be visible in use, and 5 which includes keys or other user input means, together with a visual indication of their function. The base control module may also include a control panel which includes keys and a visual indication of their function. The remote control module may include means for fastening the control 10 module to the arm, leg or torso portion of a wearer.

An example of a base control module and remote control module are shown in Figures 27a and 27b. The base and/or remote control module may include any one or more of the following control functions.

- 15 1. Climate control fan, including speed and turbo boost (which may be time limited).
2. Speaker volume control.
3. Search light control on/off, and/or intensity level.
- 20 4. Visor defogger (which may comprise a heater associated with the visor)
5. Control panel back light (for eliminating the control functions in poor light).

The base control module and/or the remote control 25 module may be adapted to control any other functions.

The base control module mounted to the helmet may include a power source for driving the various electrical devices associated with the head protector and may store

sufficient electrical energy to obviate the need for an auxiliary portable power source.

Figure 28 shows a perspective view of an embodiment of an EOD helmet with the visor in various 5 positions;

Figure 29 shows a front view of the EOD helmet shown in Figure 28, Figure 30 shows a side view thereof, Figure 31 shows a top view thereof, Figure 32 shows a back view thereof; and Figure 33 shows a view from below the 10 helmet shown in Figure 28.

Figure 34 shows perspective views of a search helmet with the search visor in various positions. In this embodiment, the helmet portion may be the same as that shown in Figures 28 to 33 and the function of the helmet has 15 changed simply by exchanging the EOD visor for the search visor.

Figure 35 shows perspective views of an NBC helmet with the visor in various positions, Figure 36 shows a front view of the helmet shown in Figure 35, Figure 37 shows a 20 side view thereof, and Figure 38 shows a back view thereof. In this embodiment, the helmet portion of the head protector may be the same as that shown in Figure 28 and the function of the helmet may be changed by simply exchanging the EOD visor for the NBC visor to accommodate a respiratory mask.

25 Figure 39 shows a part cross-sectional view through a helmet towards the rear thereof, and Figure 40 shows a perspective cross-sectional view through a front portion of the helmet and a cross-sectional side view through a helmet.

Modifications or changes to the embodiments described above will be apparent to those skilled in the art.

CLAIMS:

1. A helmet comprising a shell, a shield member and coupling means for coupling the shield member to the shell and permitting movement of said shield member relative to said shell, and shock absorption means coupled to said coupling means and arranged to permit movement of said shield member relative to said shell independently of said coupling means.
5
2. A helmet as claimed in claim 1, wherein said coupling means comprises pivot means for pivotally coupling said shield member to said shell.
10
3. A helmet as claimed in claim 2, wherein said pivot means comprises a pin or bolt coupled to said shield member.
15
4. A helmet as claimed in any preceding claim, wherein said shock absorption means comprises a member formed of a resilient material.
20
5. A helmet as claimed in claim 4, wherein said coupling means comprises pivot means for pivotally coupling said shield member to said shell, and wherein said resilient member defines an aperture for receiving said pivot means.
25
6. A helmet as claimed in claim 5, further comprising a mounting block secured to said shell and having a receptacle for receiving said resilient member.
30
7. A helmet as claimed in claim 1, wherein said coupling means is arranged to permit slidable movement of said shield member relative to said shell.
35
8. A helmet as claimed in any preceding claim, wherein said shield member comprises a visor.
40

9. A helmet comprising a shell and a shield member coupled to said shell for movement between a first position and a second position relative to said shell, and

5 a locking system for locking said shield member in at least one of said first and second positions and comprising a rotary cam mounted on said shell, an aperture formed in said shield member and an opening in the side of said aperture for receiving said cam into said aperture, said aperture permitting rotation of said cam when located 10 in said aperture to a position which prevents movement of said cam from said aperture through said opening.

10. A helmet comprising a shell and a shield member coupled to said shell for movement between a first position and a second position relative to said shell, and

15 a locking system for locking said shield member in at least one of said first and second positions, and comprising a lock for preventing movement of said shield member relative to said shell and a manually accessible, depressible member adapted to release said lock on 20 depression thereof, thereby allowing said shield member to move from the respective first or second position.

11. A helmet as claimed in claim 10, further including biasing means for biasing said lock into its locking position.

25 12. A helmet as claimed in claim 10 or 11, wherein said lock comprises a movable member coupled to said depressible member, and one of said shell and said shield member includes receiving means for receiving said moveable member.

30 13. A helmet as claimed in claim 11, further comprising a lock mounting which includes a mounting member

mounted to said shell and having an aperture for receiving said depressible member, and wherein said shield has an aperture formed therein for receiving said movable member.

14. A helmet as claimed in claim 13, wherein said lock 5 mounting further comprises a block adjacent said shell and having a recess for receiving said movable member on depression of said depressible member.

15. A helmet as claimed in claim 14, further including 10 biasing means for urging said moveable member out of said recess.

16. A helmet as claimed in claim 15, wherein said biasing means comprises a spring.

17. A helmet as claimed in any one of claims 14 to 16, comprising a resilient member for coupling said mounting 15 block to said shell and arranged to permit movement of said shield relevant to said shell in a direction towards the interior of said shell.

18. A helmet as claimed in any one of claims 14 to 17, wherein said mounting block includes coupling means for 20 coupling said shield to said shell to allow said shell to move between said first position and said second position.

19. A helmet as claimed in any one of claims 9 to 19, wherein said shield comprises a visor.

20. Protective armour comprising a layer of a plastic, 25 transparent material,

a plurality of layers of high performance material, said layers being bonded together to form a laminate, and

securing means for securing said laminate to said layer of plastic transparent material.

21. Protective armour as claimed in claim 20, wherein said plastic transparent material comprises polycarbonate.

5 22. Protective armour as claimed in claim 20 or 21, wherein said securing means comprises urethane between said layer of plastic transparent material and said laminate.

23. Protective armour as claimed in any one of claims 20 to 22, wherein said high performance material comprises a 10 high performance fabric.

24. A visor for a helmet comprising a layer of plastic transparent material, a plurality of layers of high performance material, said layers being bonded together to form a laminate and securing means for securing said 15 laminate to a portion of the surface of said plastic transparent material.

25. A visor as claimed in claim 24, wherein said plastic transparent material comprises polycarbonate.

26. A visor as claimed in claim 24 or 25, wherein each 20 of said plurality of layers comprises a composite of high performance material and thermo-plastic or thermo-set resin.

27. A visor as claimed in any one of claim 24 to 26, wherein said securing means comprises urethane.

28. A visor as claimed in any one claims 24 to 27, 25 further comprising a further layer of plastic transparent material overlaying said first layer.

29. A visor as claimed in claim 28, wherein said further layer comprises one of polycarbonate and acrylic.

30. A process for forming protective armour comprising the steps of providing a layer of plastic transparent material,

5 forming a laminate comprising a plurality of layers of high performance material and securing said laminate to said layer of plastic transparent material.

31. A process as claimed in claim 30, wherein the step of forming said laminate comprises providing a plurality of layers of high performance composite material and applying 10 at least one of pressure and heat to said plurality of layers to secure said layers together.

32. A process as claimed in claim 30 or 31, wherein the step of securing comprises bonding the plastic transparent material to said laminate using urethane.

15 33. A process as claimed in claim 32, wherein the step of securing comprises positioning a sheet or layer of urethane between said plastic transparent material and said laminate and applying at least one of heat to said urethane sheet and pressure between said plastic transparent material 20 and said laminate.

34. A process as claimed in any one of claims 30 to 33, further comprising applying shape to at least one of the surface of said plastic transparent material and said laminate before securing said layer to said laminate.

25 35. A helmet comprising a shell, a strap guide mounted on each side of the helmet in a position for supporting a strap for passing under the chin of a wearer, when in use,

30 a strap which passes through and between each strap guide such that the portion of said strap between said strap guides form a chin strap,

a support member coupled to the rear of said shell to allow relative movement between said support member and said shell and for engaging a portion of the head or neck of a wearer, when in use, said strap extending from each strap 5 guide to said support member, and

a pull member extending from a position between said support member and said strap guides and which is arranged to cause the length of said strap extending from said support member through said strap guides to shorten 10 when said pull member is pulled.

36. A helmet as claimed in claim 35, further comprising a further pull member extending from said support member, an which is arranged to cause the length of said strap extending from said support member through said strap 15 guides to shorten when said further pull member is pulled.

37. A helmet as claimed in claim 35 or 36, further comprising resistance means for resisting extension of the length of said strap extending from said support member through said strap guides on releasing the or each pull 20 member.

38. A helmet as claimed in claim 37, further comprising release means for disabling said resistance means.

39. A helmet as claimed in claim 38, wherein said 25 release means includes a pull tab arranged to disable to said resistance means when said pull tab is pulled.

40. A helmet as claimed in any one of claims 35 to 39, further comprising a connector for releasably connecting one portion of said strap to a second portion of said strap and 30 positioned within the length of said strap which extends from said support member through said strap guides.

41. A helmet as claimed in claim 40, wherein said connector is positioned between said strap guides.

42. A retention system for a helmet comprising first and second strap guides for mounting on each side of the 5 helmet in a position for supporting a strap for passing under the chin of a wearer, when in use, a strap which passes through and between each strap guide, the portion of said strap between said strap guides forming a chin strap, a support member for movably coupling to the rear of said 10 helmet for engaging a portion of the head or neck of a wearer when in use, said strap extending from each strap guide to said support member, and pull members extending from said support member and which are arranged to cause the length of said strap extending from said support member 15 through said strap guides to shorten when said pull members are pulled.

43. A retention system as claimed in claim 42, further comprising resistance means for resisting extension of said length on releasing said pull member.

20 44. A retention system as claimed in claim 42, further comprising release means for disabling said resistance means.

45. A retention system as claimed in any one of claims 42 to 44, wherein the or each pull member comprises an 25 extension of said strap.

46. A helmet as claimed in any one of claims 35 to 41, wherein the or each pull member comprises an extension of said strap.

47. A helmet comprising a shell, an electrically 30 powered system for assisting a wearer, and a power controller for controlling the power delivered to said

system, wherein said power controller is releasably mounted to said shell.

48. A helmet as claimed in claim 47, wherein said power controller comprises monitoring means for monitoring a 5 condition of said controller.

49. A helmet as claimed in claim 48, further comprising an indicator for indicating said condition.

50. A helmet as claimed in claim 49, wherein said indicator comprises any one or more of an audio indicator, a 10 visual indicator and a tactile indicator.

51. A helmet as claimed in any one of claims 47 to 50, comprising a housing unit for housing said power controller, said housing unit being releasably mounted to said shell and said housing unit further comprising electrically powered 15 means for providing ventilation air to the interior of said helmet.

52. A helmet as claimed in claim 51, further comprising a visor, said visor having a moisture reducing treatment on the surface thereof facing the interior of the 20 shell.

53. A helmet comprising a shell, a visor having a moisture reducing means treatment on the surface thereof facing the interior of the shell, and electrically powered means for providing ventilation air to the interior of said 25 helmet, said electrically powered means being mounted to said helmet.

54. A helmet as claimed in claim 53, wherein said electrically powered means is mounted adjacent said helmet.

55. A helmet as claimed in claim 53 or 54, comprising a housing unit housing said electrically powered means and which is releasably mounted on said shell.

56. A helmet as claimed in claim 55, wherein said 5 housing unit is mounted on the exterior of said shell.

57. A helmet as claimed in any one of claims 47 to 56, comprising a visor, said visor comprising a layer of transparent plastic material and a laminate secured to said layer, said laminate comprising a plurality of layers of 10 high performance material.

58. A helmet as claimed in claim 57, wherein said laminate is secured to said layer of transparent plastic material by urethane.

59. A helmet as claimed in claim 58, wherein each 15 layer of said laminate comprises a composite of high performance material and thermo-plastic resin.

60. A control unit for controlling an electrically powered system for a helmet, the control unit having securing means for releasably securing the control unit to a 20 helmet.

61. A control unit as claimed in claim 60, further comprising a monitor for monitoring a condition of said control unit.

62. A control unit as claimed in claim 61, further 25 comprising an indicator for indicating said condition.

63. A control unit as claimed in claim 62, wherein said indicator comprises any one or more of an audio indicator, a visual indictor and a tactile indicator.

CLAIM SET 2

1. A protective system comprising a helmet, at least one electrically operated device mounted to said helmet, a first controller mounted to said helmet for controlling said device, and a second controller for controlling said device from a location remote from said helmet, means for transmitting control signals from said second controller to said device, wherein said second controller includes fastening means for fastening the controller to a part of a wearer's body so that, in use, the second controller is visible to the wearer.
2. A protective system as claimed in claim 1, wherein said first and second controllers are arranged to control at least one function of the device which is the same function.
- 15 3. A protective system as claimed in claim 2, wherein said device is arranged to control said function in response to a control command from either of said first and second controllers.
4. A protective system as claimed in any preceding 20 claim, wherein said electrical device comprises one of: a fluid impeller, an amplifier, a microphone, a speaker, a light source, and a heater.
5. A protective system as claimed in any preceding claim, wherein said fastening means is adapted for fastening 25 said second controller to a limb of a wearer, for example, a hand, wrist, arm or leg.
6. A head protector comprising a helmet shell having a head cavity therein, a liner for lining said head cavity, wherein at least one of the liner and the shell includes at 30 least one retainer for slidably receiving a packing member for adjusting the size of the head cavity.

7. A head protector as claimed in claim 6, wherein the liner has an exterior face towards the head cavity and an opposed interior face towards the helmet shell, and said at least one retainer is exposed on the interior face of the
5 liner.

8. A head protector as claimed in claim 6 or 7, having opposed sides, a front and a back, and at least one retainer on one side of the head protector and at least one retainer on the other side of the head protector.

10 9. A head protector as claimed in any preceding claim, wherein said head protector has opposed sides, a front and a back, and at least one retainer positioned at the front of the head protector.

15 10. A head protector as claimed in any preceding claim, having opposed sides, a front and a back, and at least one retainer positioned at the back thereof.

11. A head protector as claimed in any preceding claim, wherein the exterior face of said liner includes fluted portions in which the flutes extend between upper and
20 lower regions of the liner.

12. A head protector as claimed in claim 11, wherein said flutes are formed by compressing regions of said liner.

13. A head protector as claimed in claim 12, wherein said flutes are formed by stitching.

25 14. A head protector as claimed in claim 13, wherein said stitching provides a means of fastening the or each retainer to said liner.

15. A head protector as claimed in any preceding claim, further comprising fastening means for securing the
30 liner to the helmet shell.

16. A head protector as claimed in claim 15, wherein said fastening means is positioned adjacent a peripheral edge of said helmet shell.
17. A head protector as claimed in claim 15 or 16, 5 wherein said fastening means comprises a zipper.
18. A head protector as claimed in any preceding claim, further comprising a form sustaining insert insertable in said shell, and wherein said retaining means includes a layer of material over the interior face of said 10 insert and said fastening means is secured thereto.
19. A head protector comprising a helmet shell and a shield, and coupling means for slidably engaging and disengaging the shield to and from the helmet shell.
20. A head protector as claimed in claim 19, further 15 including means for preventing slidable disconnection of said shield from said helmet shell.
21. A head protector as claimed in claim 20, wherein said retaining means engages to prevent said slidable disconnection in response to movement of said shield 20 relative to said helmet shell from a first position to the second position.
22. A head protector as claimed in any preceding claim, wherein said coupling means includes means for rotatably coupling said shield to said helmet shell.
- 25 23. A head protector as claimed in any preceding claim, wherein said shield comprises a visor.
24. A head protector as claimed in any preceding claim, wherein said coupling means includes means defining a slot having an open end, said means being associated with 30 one of said helmet and said shield, and means receivable

through the said open end and associated with the other of said helmet and said shield for mounting the shield on the helmet.

25. A head protector as claimed in claim 24, further comprising retaining means for retaining said receivable means in said slot.

26. A head protector as claimed in claim 25, wherein said receivable means comprises a member which allows relative rotation between said slot and said member when 10 said member is inserted in said slot, and said retaining means is arranged to prevent withdrawal of said member from said slot on rotation of said slot relative to said member from a first position, in which said withdrawal is possible, to a second position in which said withdrawal is prevented.

15 27. A head protector as claimed in any preceding claim, wherein said retaining means comprises a further slot associated with one of said shield and said helmet shell, and a further member associated with the other of said shield and said helmet shell which is arranged to travel in 20 said slot when said shield is mounted on said helmet shell and the shield is rotated from said first position.

28. A head protector as claimed in claim 27, further comprising a third slot associated with one of said shield and said helmet shell and a third member which is arranged 25 to travel in said third slot when said shield is rotated from said first position.

29. A head protector as claimed in claim 28, wherein said further and third members are disposed on opposite sides of said first member.

30. A head protector as claimed in any preceding claim, wherein said coupling includes impact absorption means between the shield and the helmet shell.

31. A head protector as claimed in claim 30, wherein 5 said first member includes said impact absorption means.

32 A head protector comprising a helmet and a retainer for retaining the helmet on the head of a wearer wherein the retainer includes means extending from the helmet for supporting a connector either side of the helmet, 10 each connector being adapted to releasably and interchangeably connect one of a function strap, a chin cup and an under-the-jaw strap thereto.

33. A protective system comprising a helmet and a plurality of visors which can be interchangeably connected 15 to the helmet and coupling means for coupling each visor to the helmet.

34. A protective system as claimed in claim 2, wherein said plurality of visors includes an EOD visor and at least one of a search visor having a larger transparent area than 20 the EOD visor and a visor adapted to accommodate a respirator or gas mask.

35. A protective system as claimed in claim 2 or 3, wherein the coupling means is adapted to permit each visor to be removably connected to the helmet without removing the 25 helmet from the head of the wearer, wherein the coupling means is adapted to permit each visor to be removably connected to the helmet without removing the helmet from the head of a wearer.

36. A protective system as claimed in any one of claims 30 2 to 4, wherein each visor is slidably connectable to the helmet.

37. A helmet and a retainer, wherein the retainer includes a retainer for passing under a lower front portion of a wearer's head, and flaps on either side of the helmet for fitting about either side of a wearer's head.

5 38. A head protector as claimed in claim 6, wherein at least one of said flaps includes a speaker.

39. A helmet having a retainer including a nape support, the nape support being connected to helmet by first and second straps which extends at an angle and transversely

10 from a common region of the nape.

40. A helmet having a retainer including a nape support and an adjustable strap for tightening the retainer about the head of a wearer, wherein the adjustable strap extends downwardly from the nape support.

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Fig 1

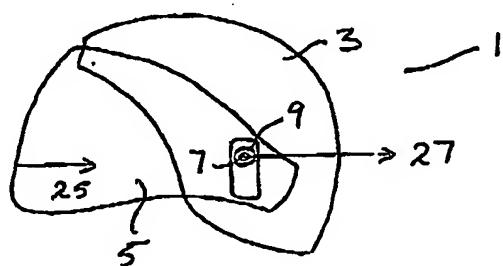
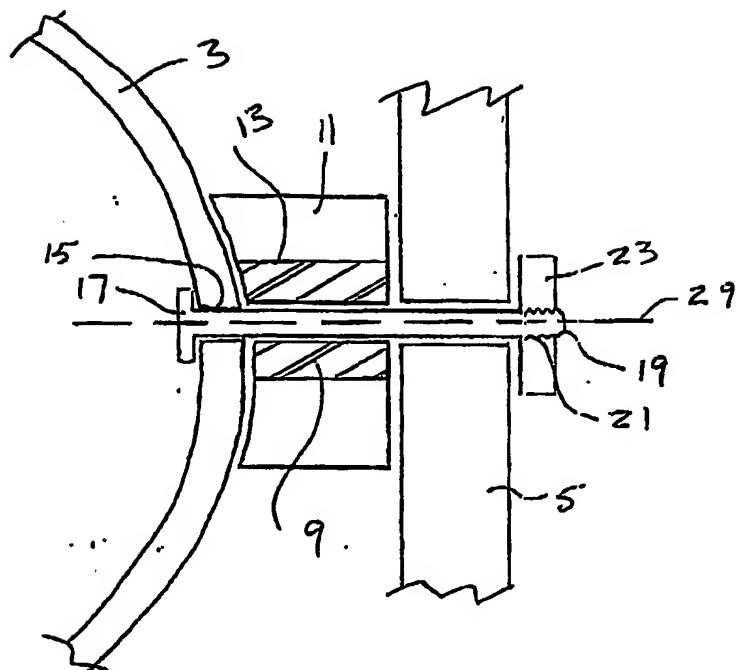
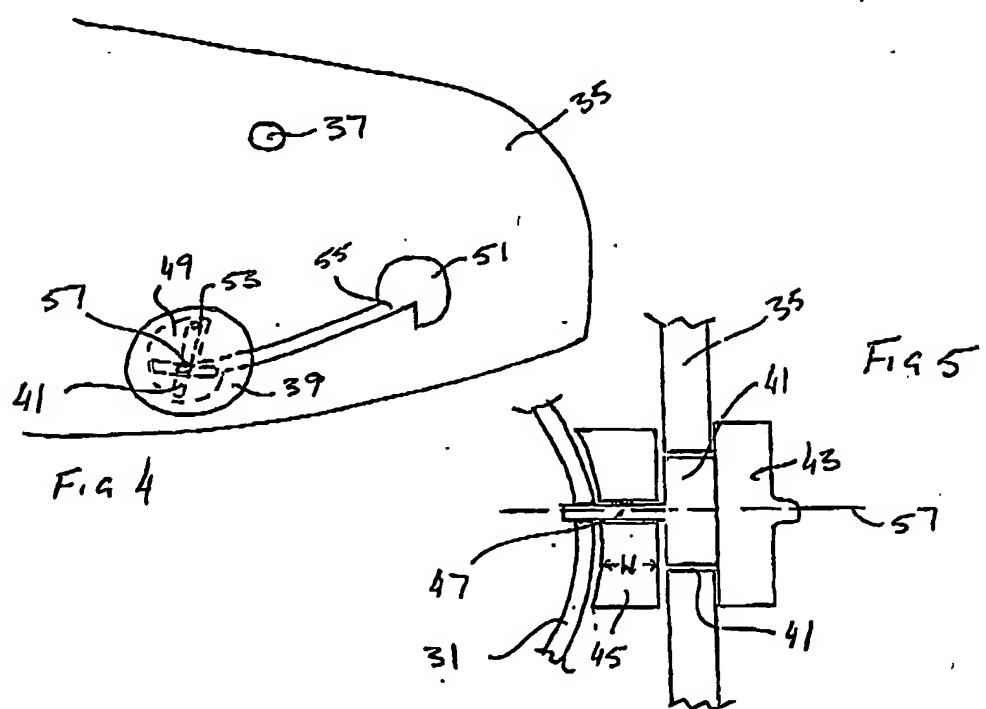
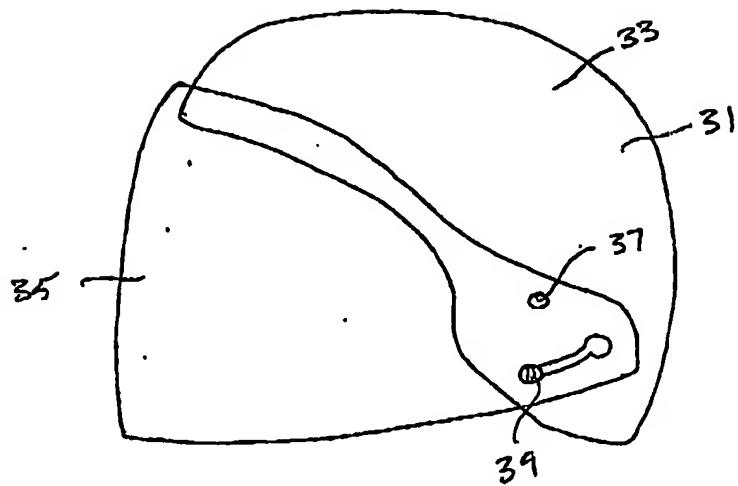
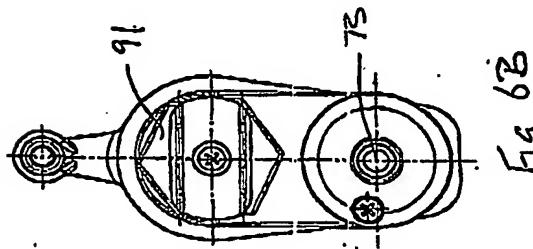
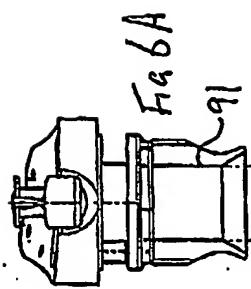
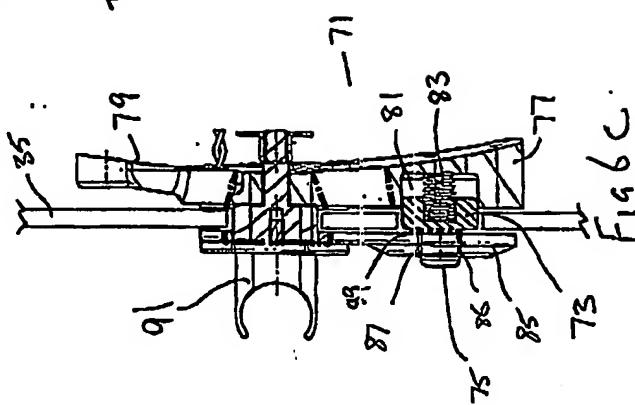
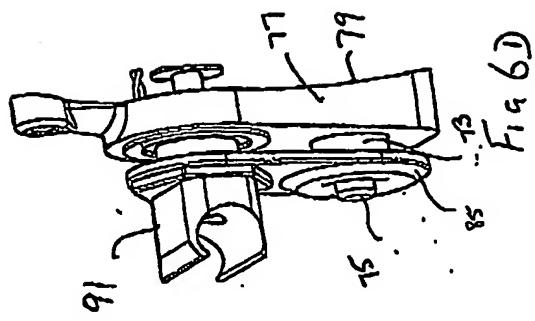


Fig 2

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Fig 3

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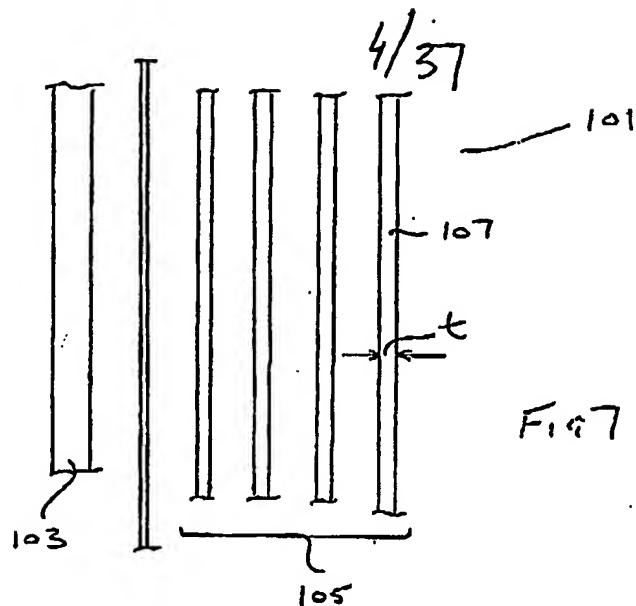


Fig 7

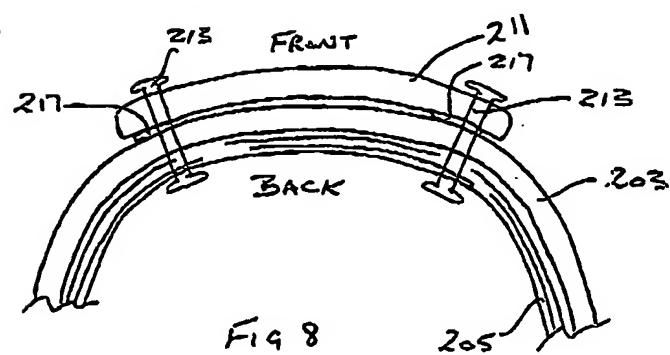


Fig 8

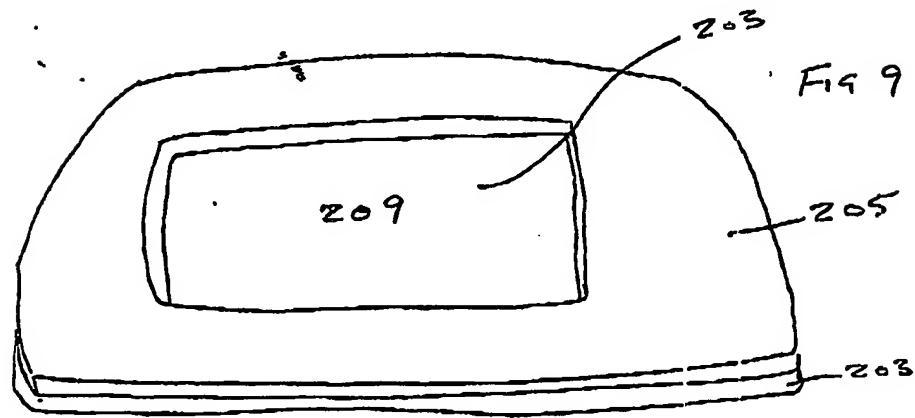
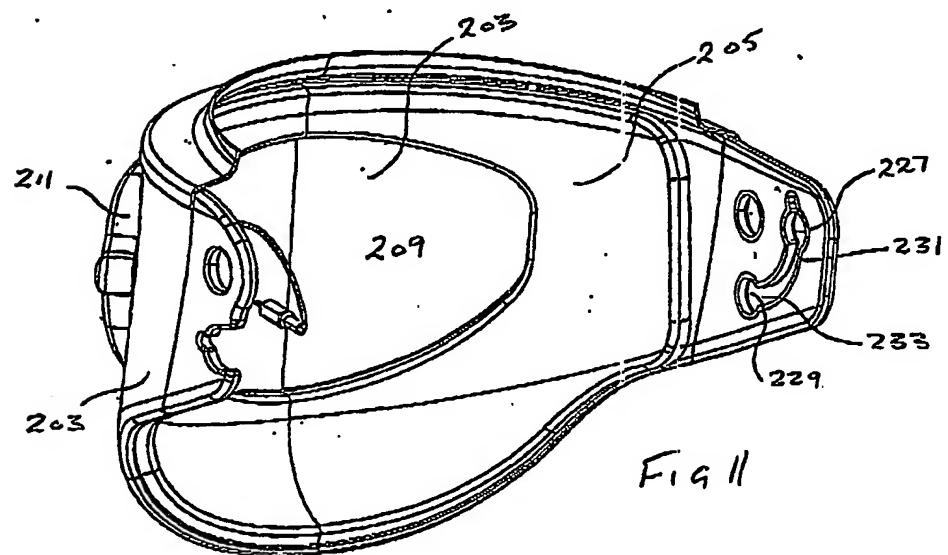
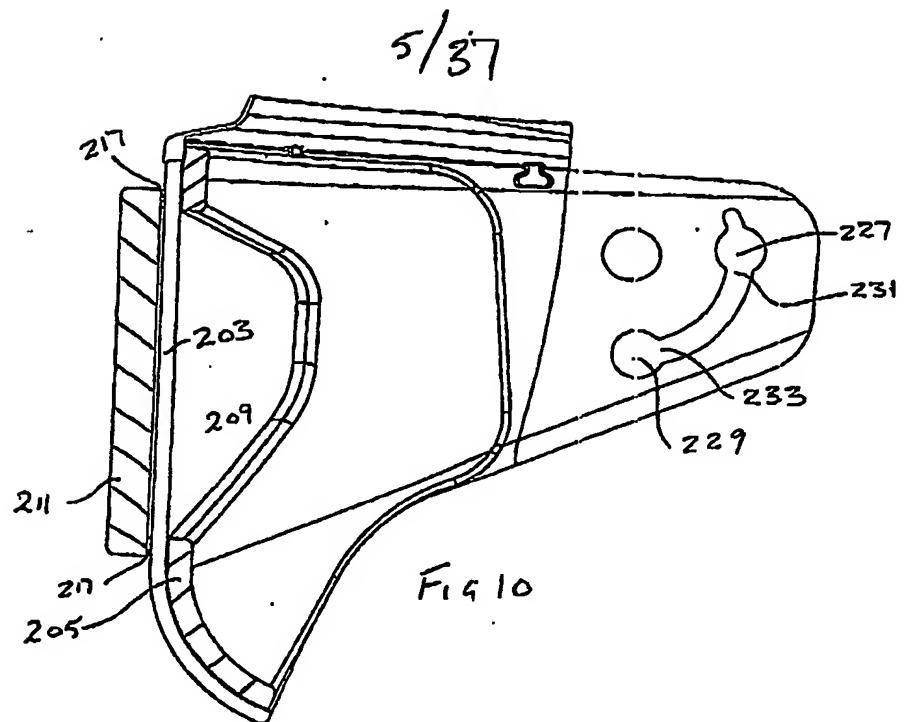


Fig 9



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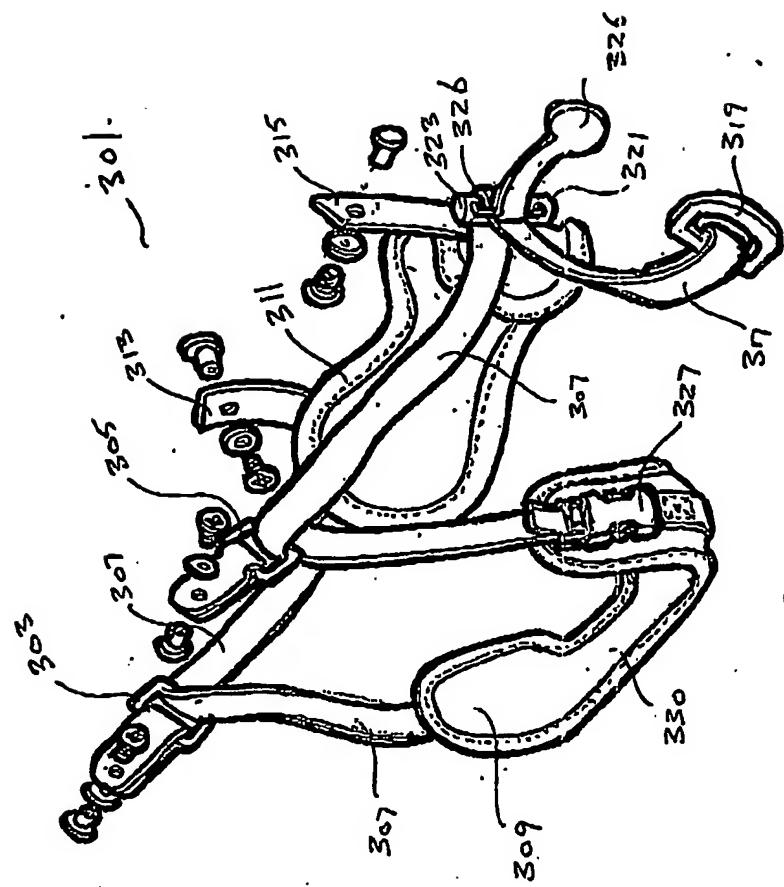


Fig. 12

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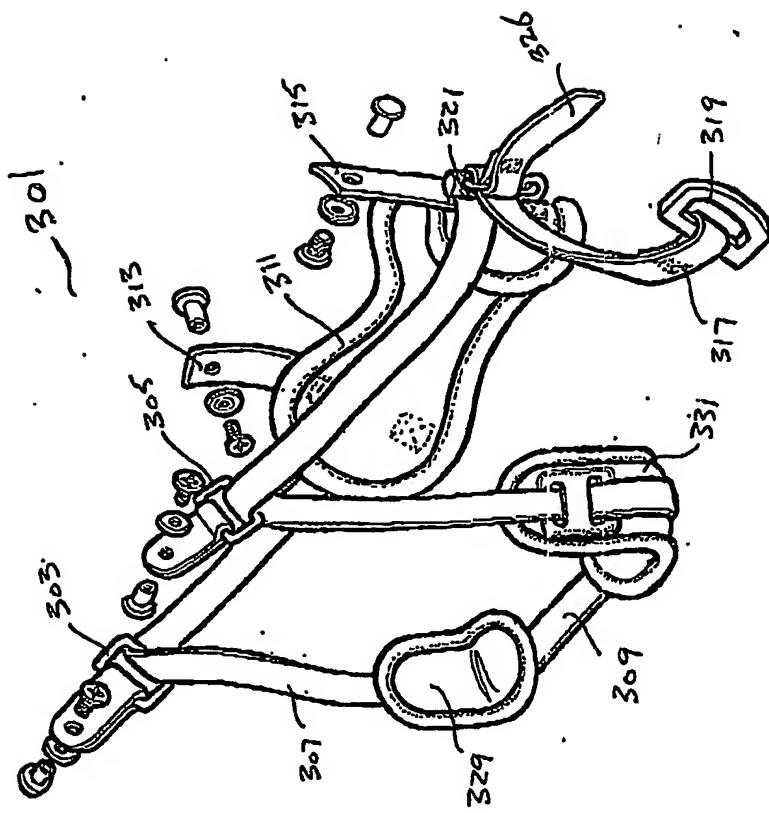


Fig 13

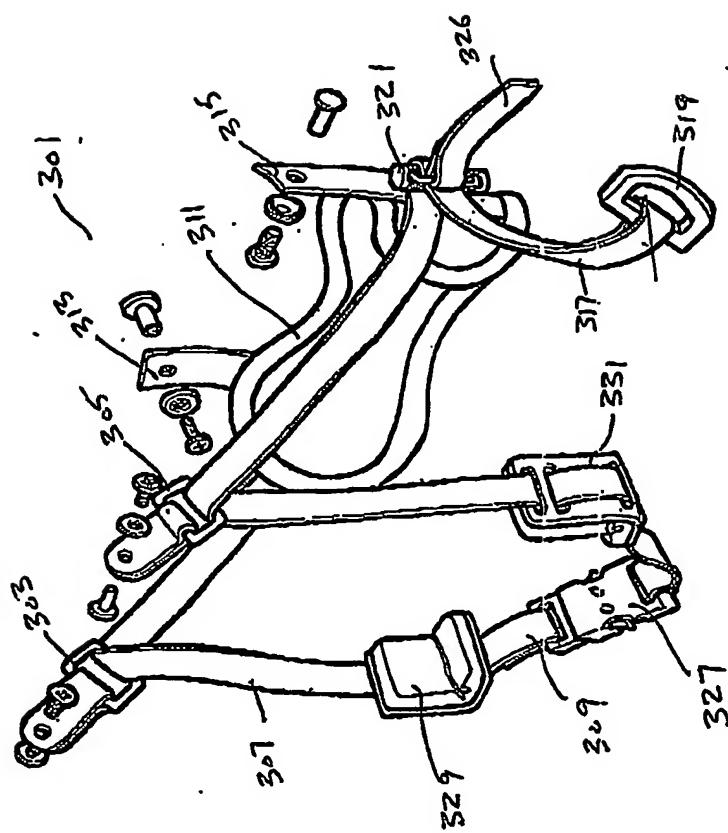
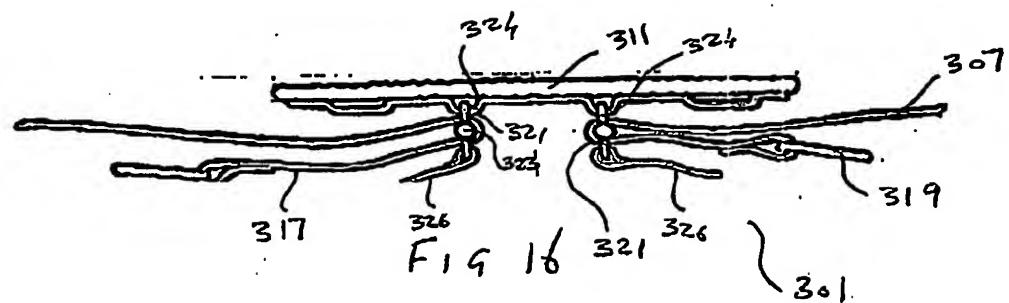
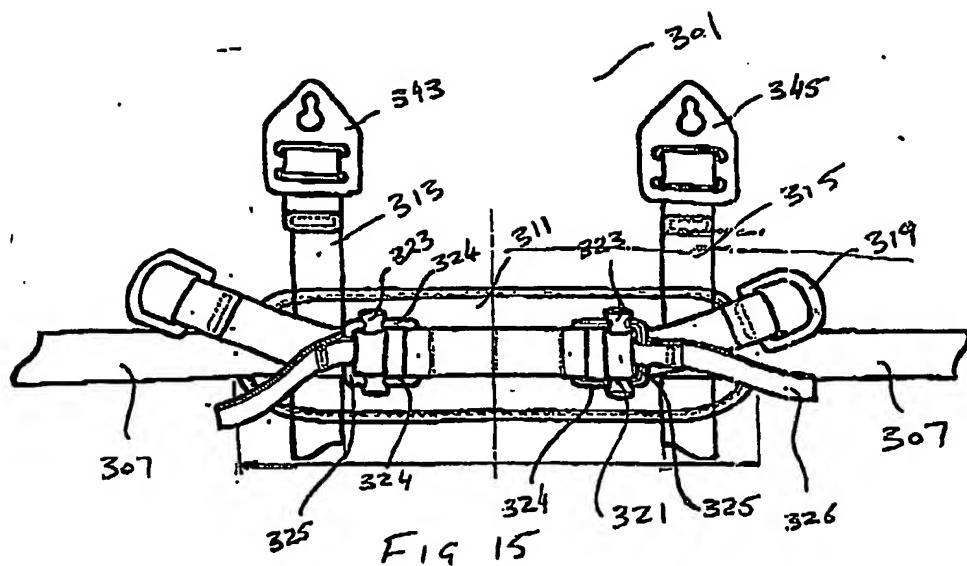
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31

Fig 14

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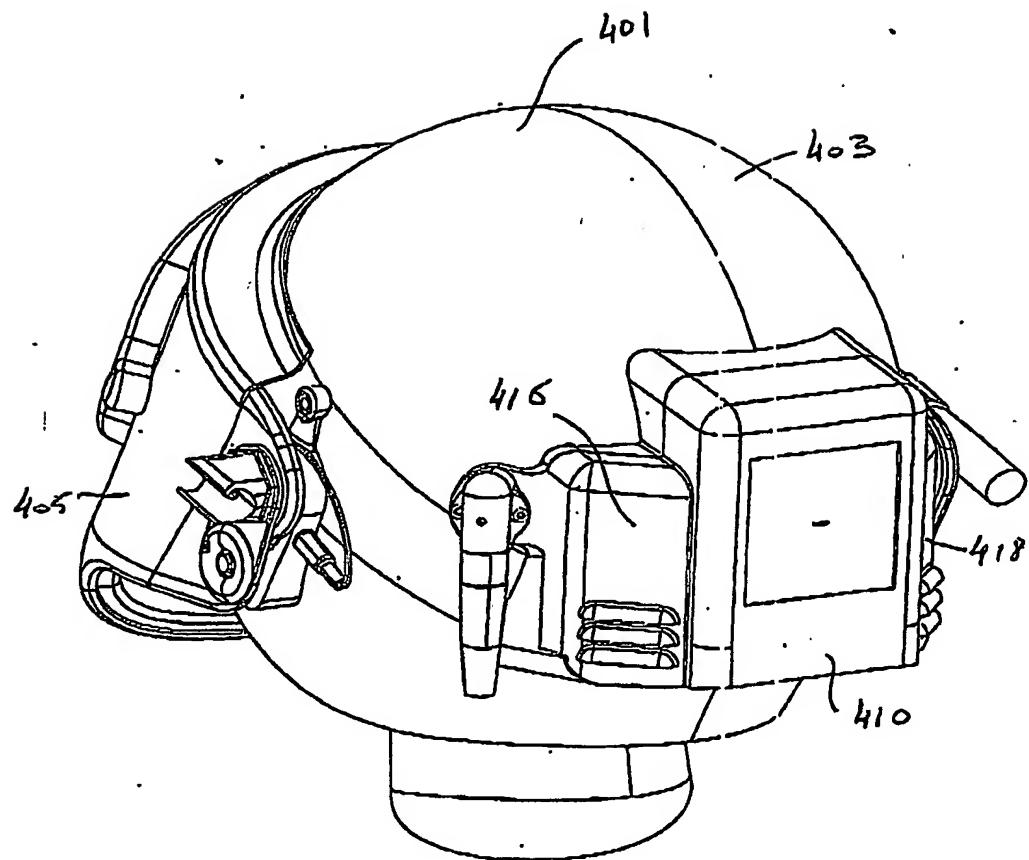
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Fig 17

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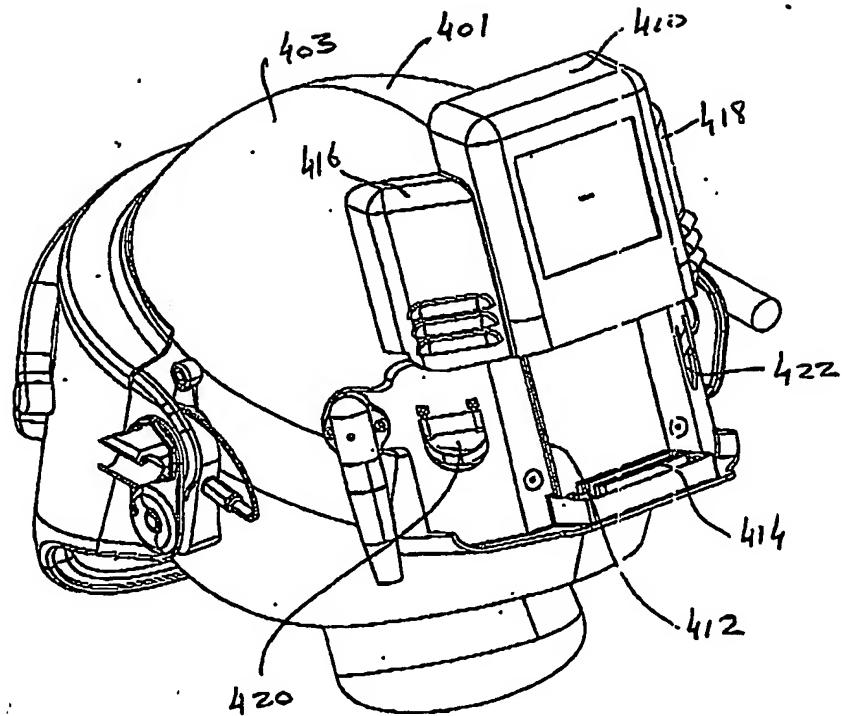


Fig 18

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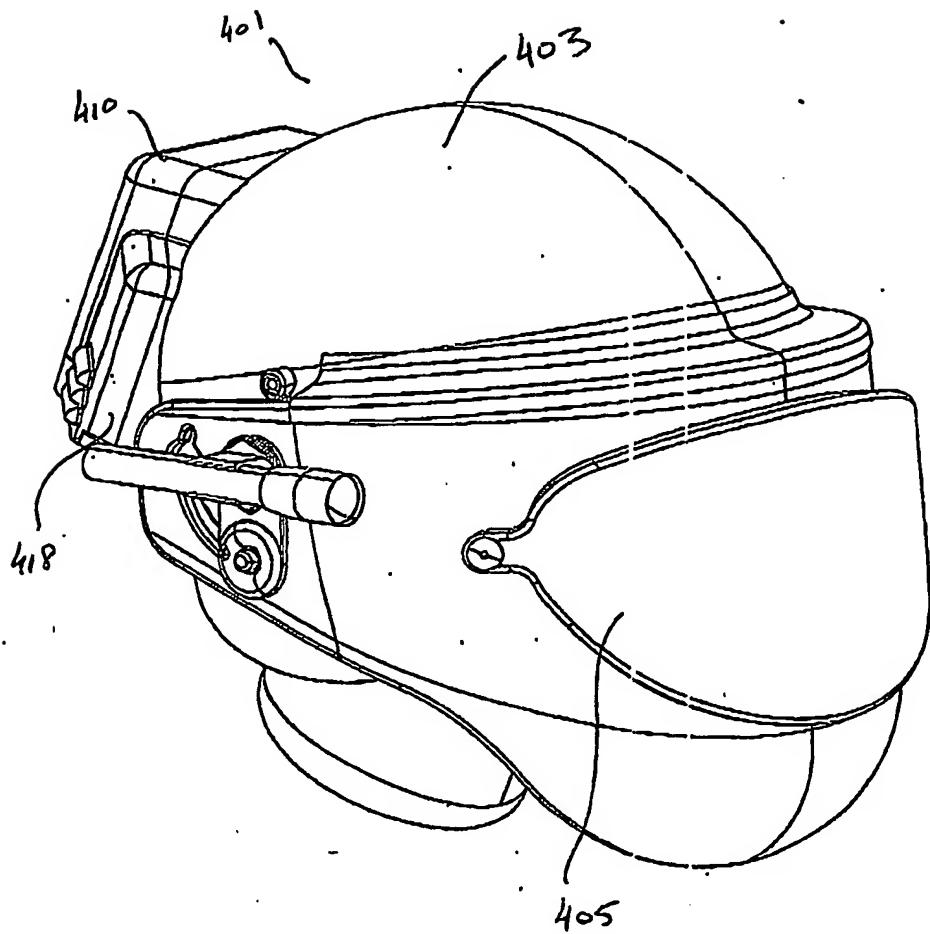


Fig 19

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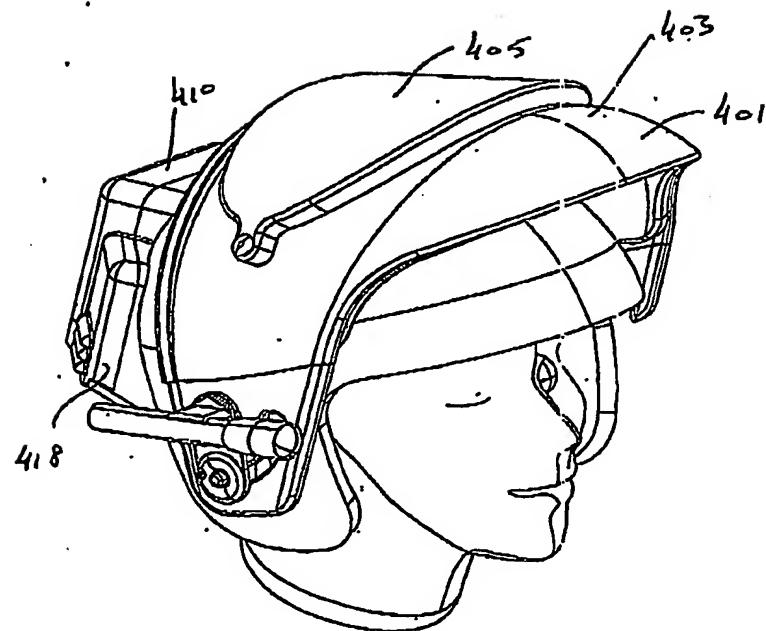


FIG 20

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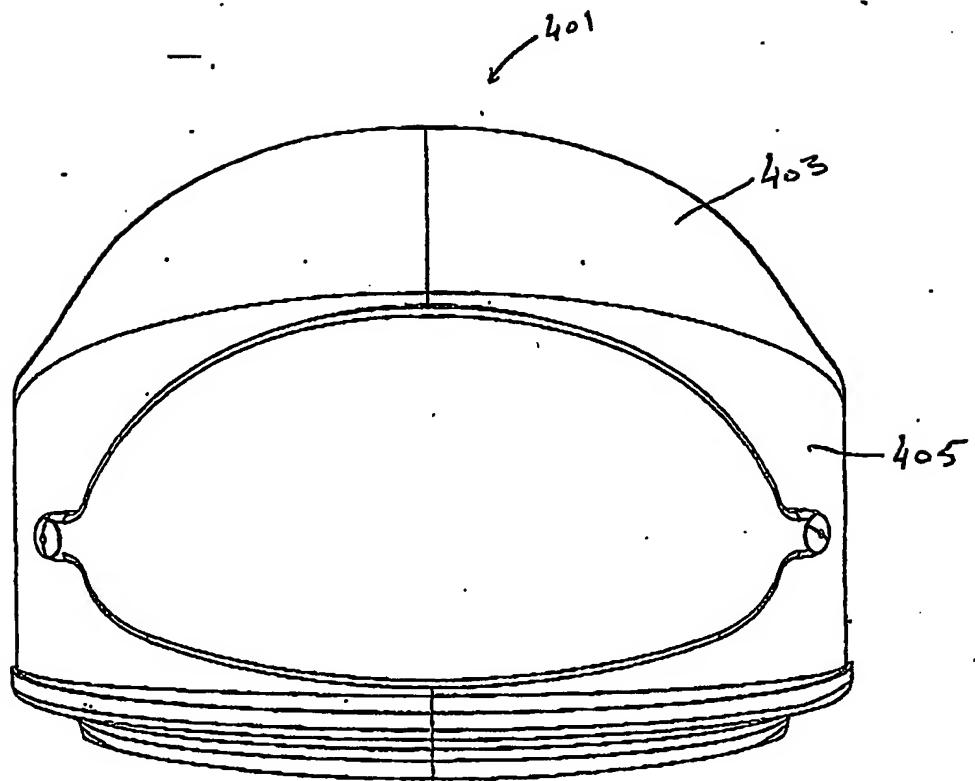


Fig 21

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WIPER FOR
SEALING
TO HELMET

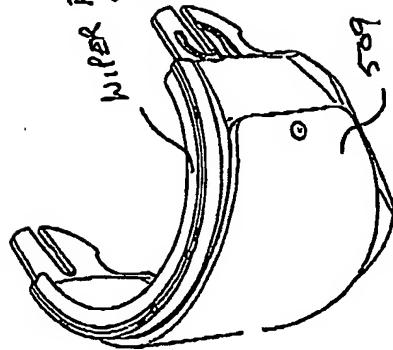


Fig 22B

WIPER SEALING
TO HELMET.

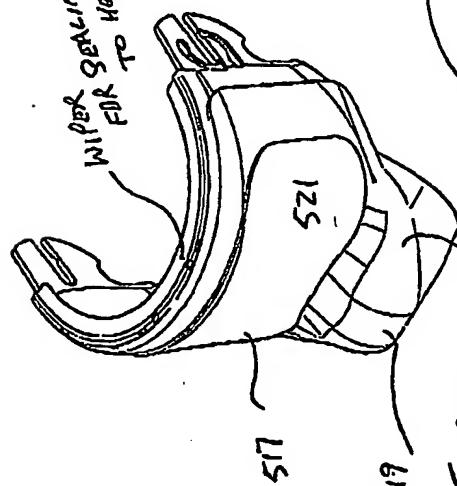


Fig 22C

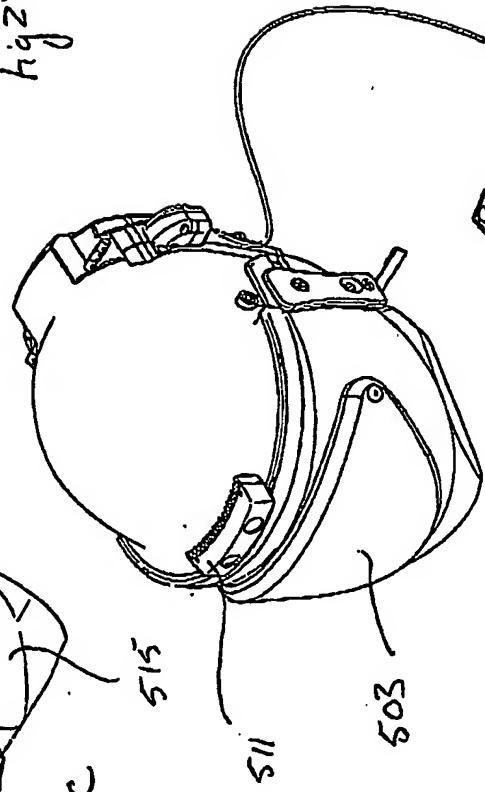
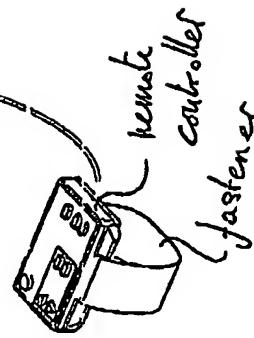
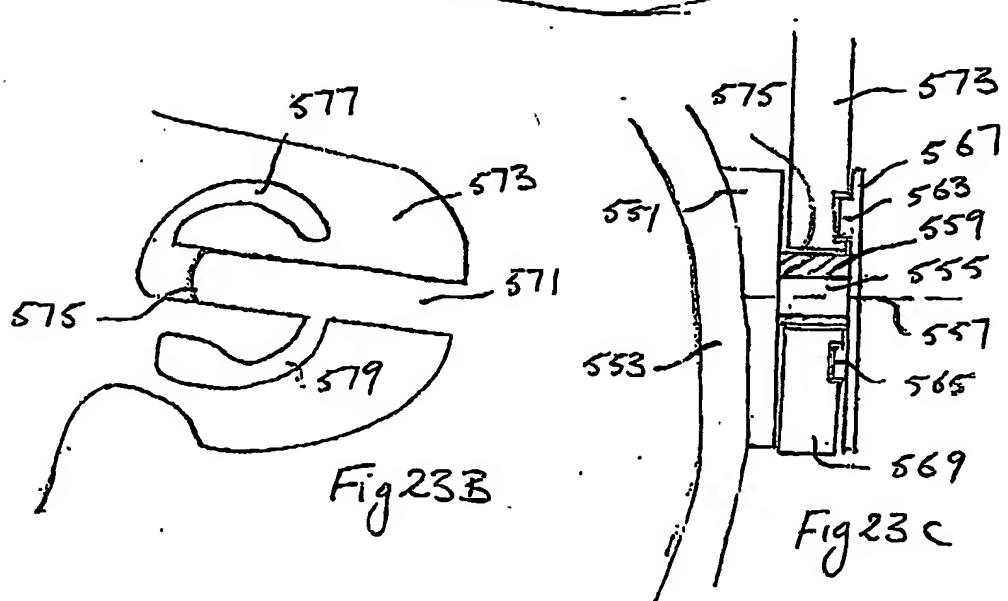
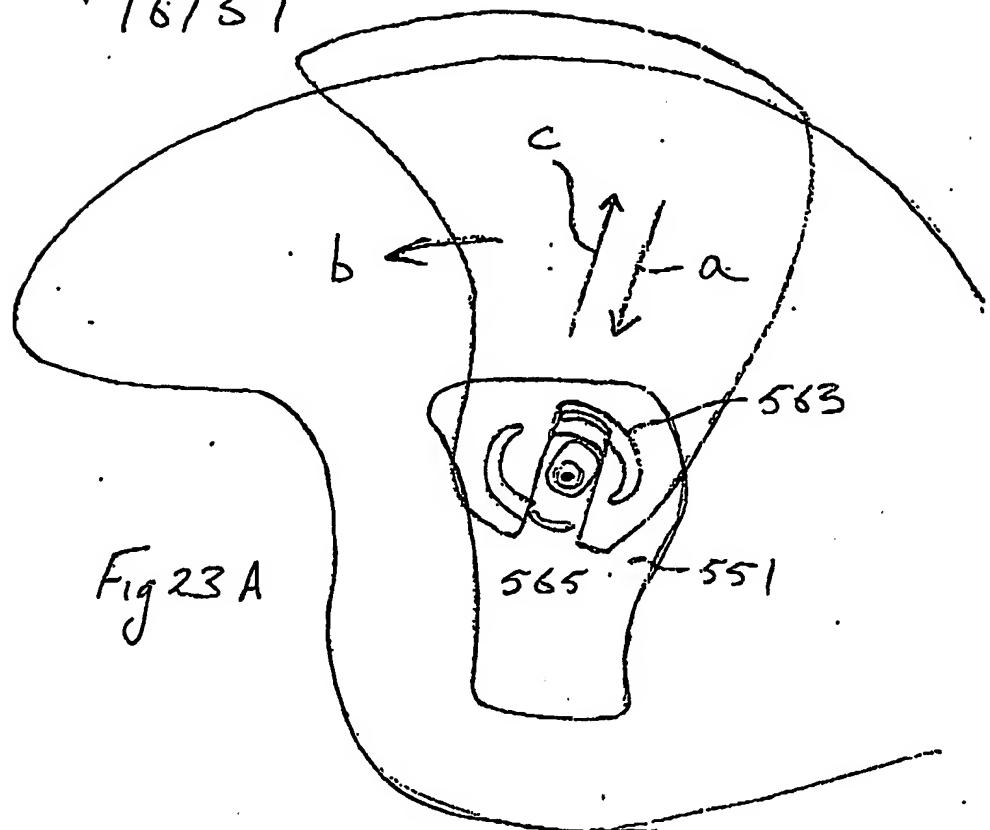


Fig 22A



remote
controller
fastener

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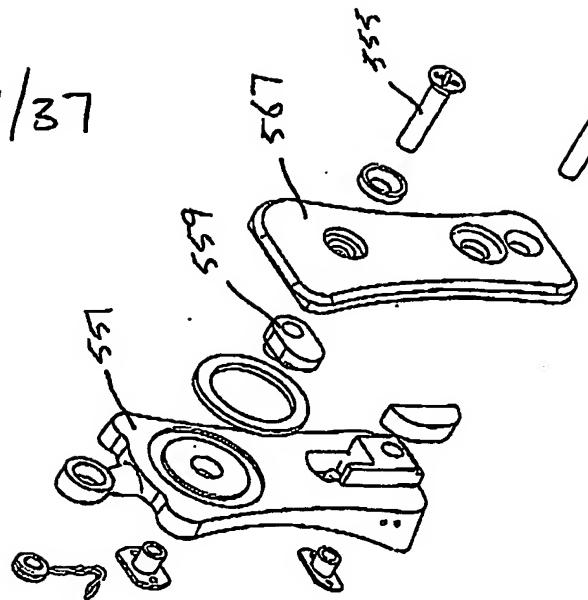


Fig 23 e

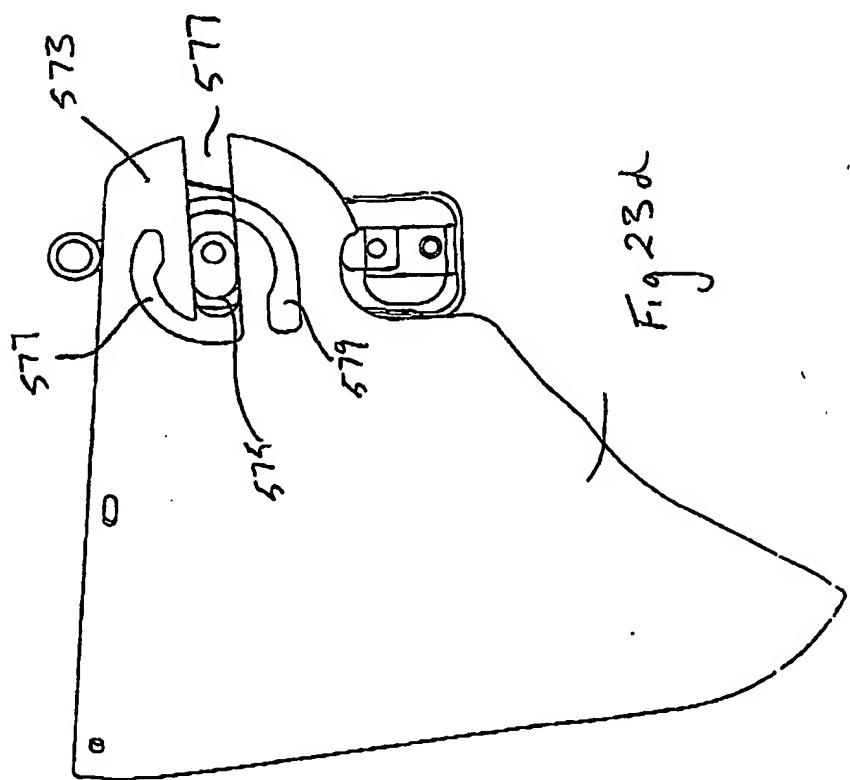
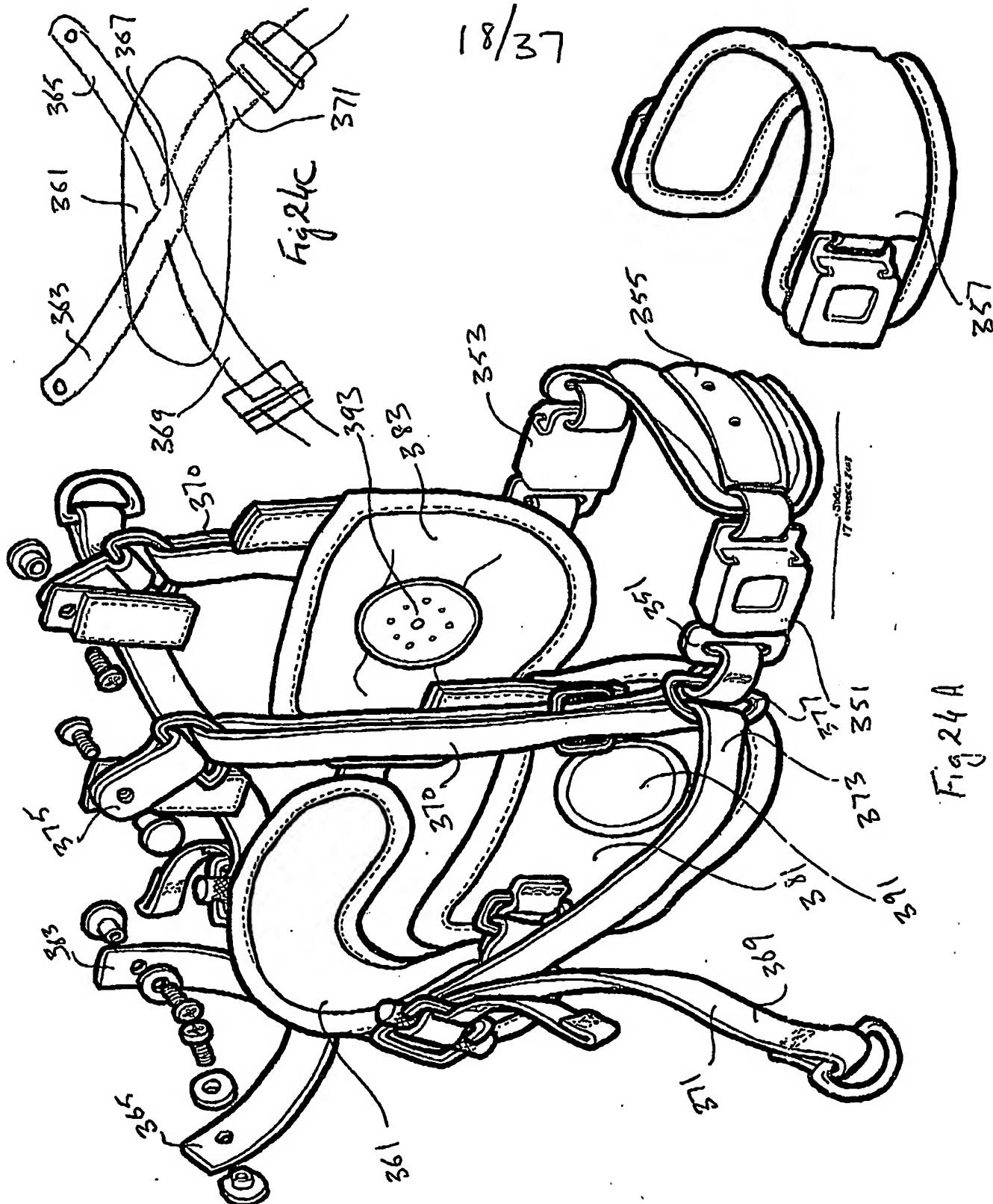
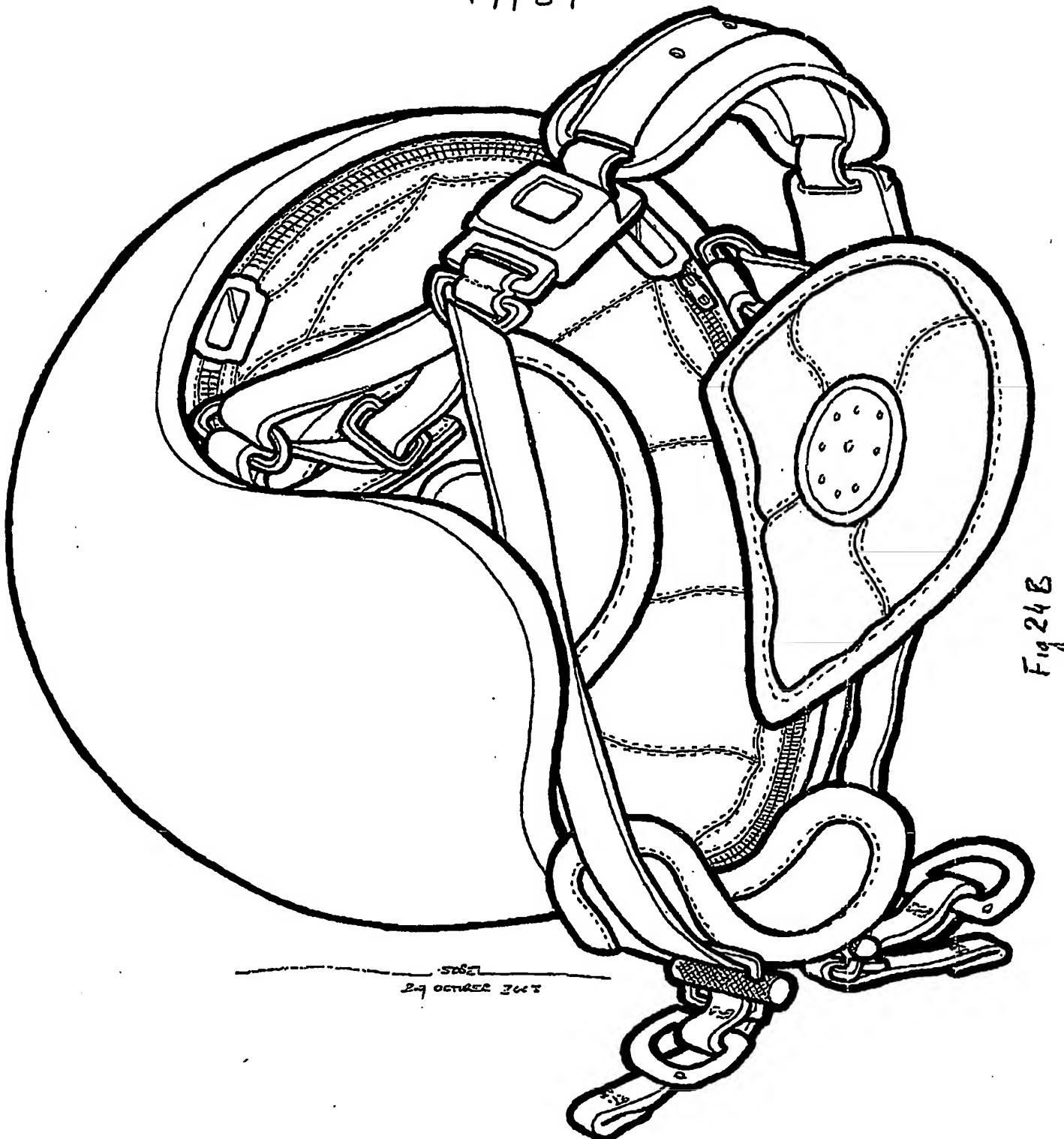


Fig 23d



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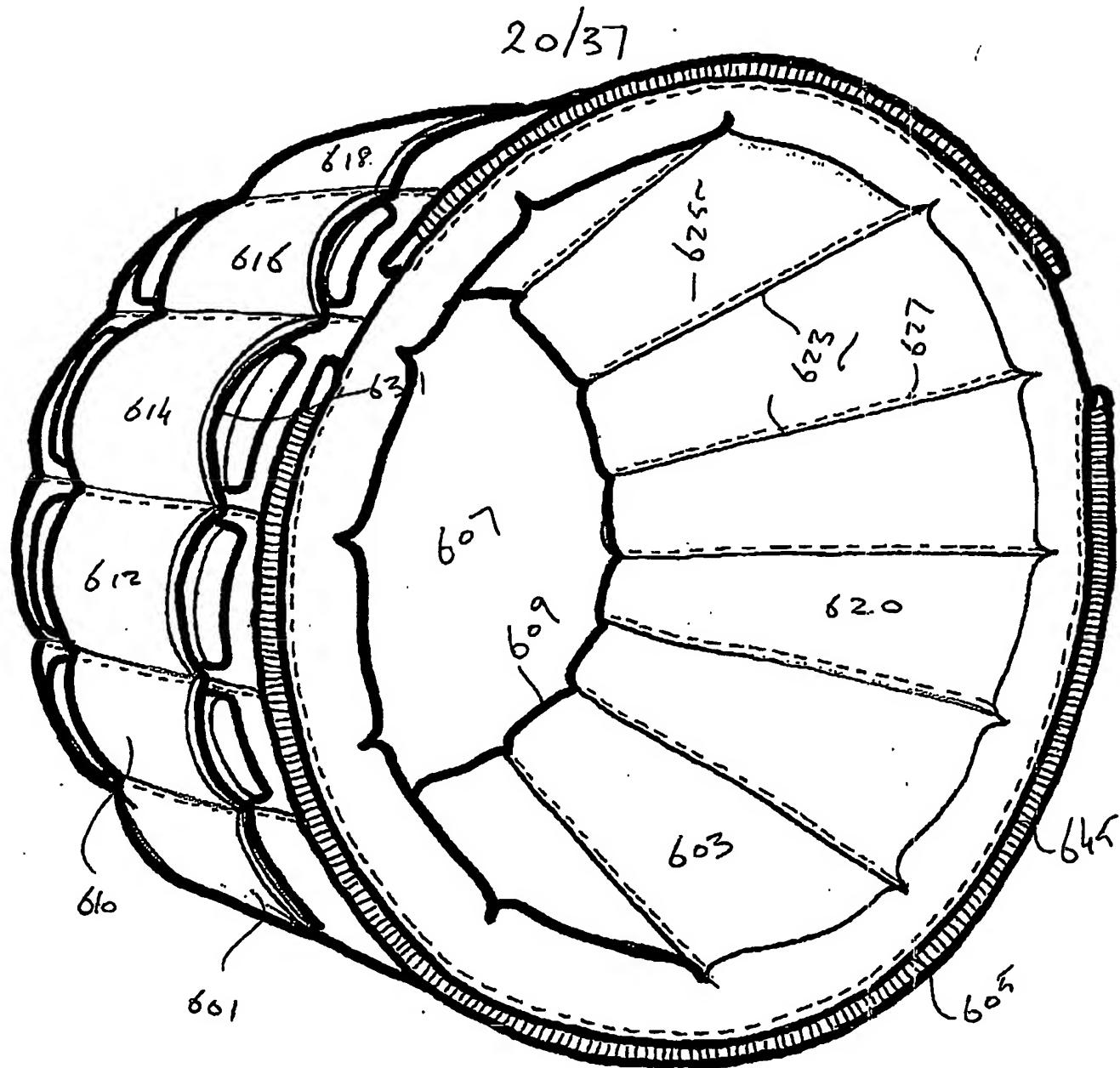
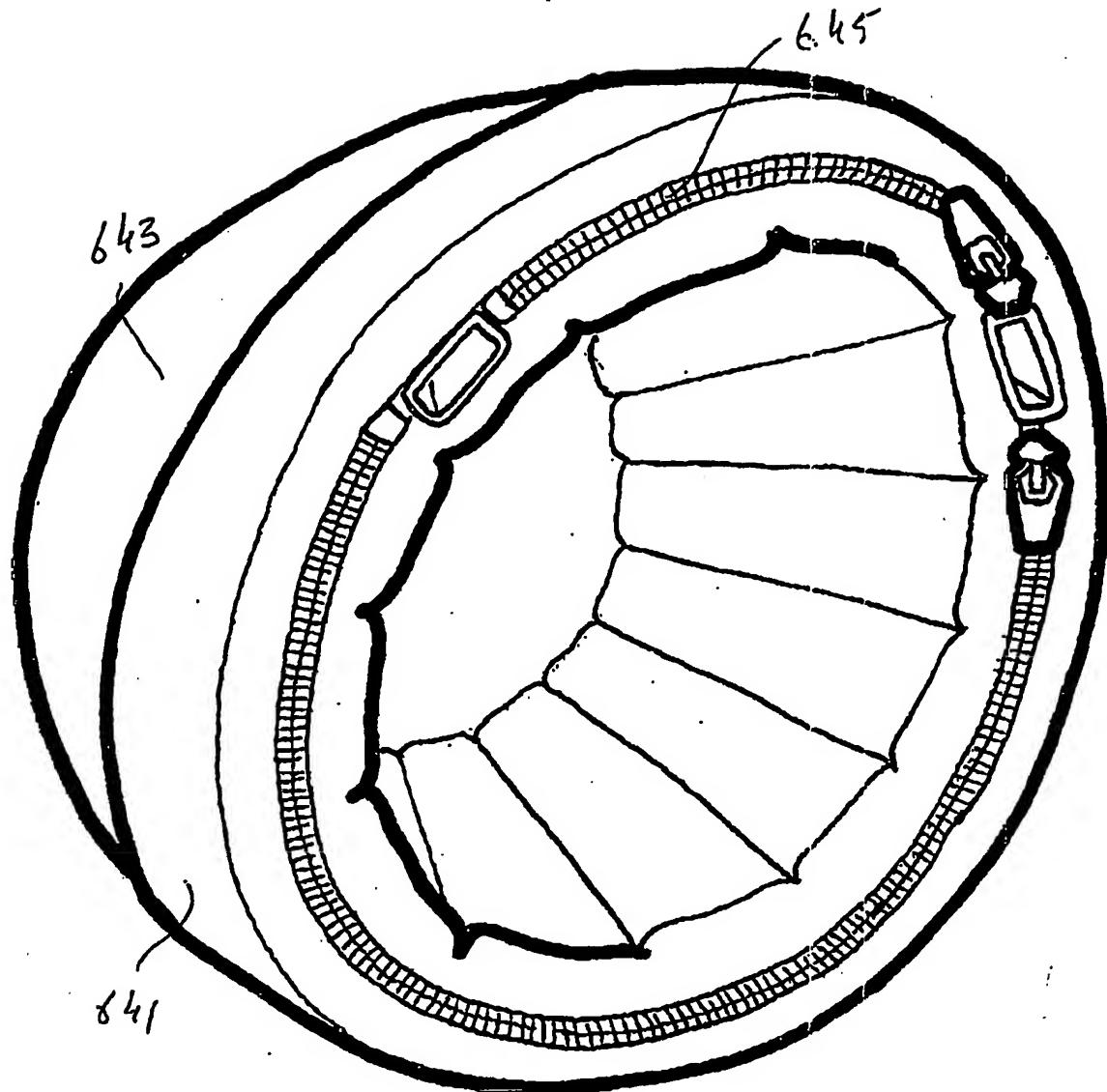


Fig 25A

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Fig 25B

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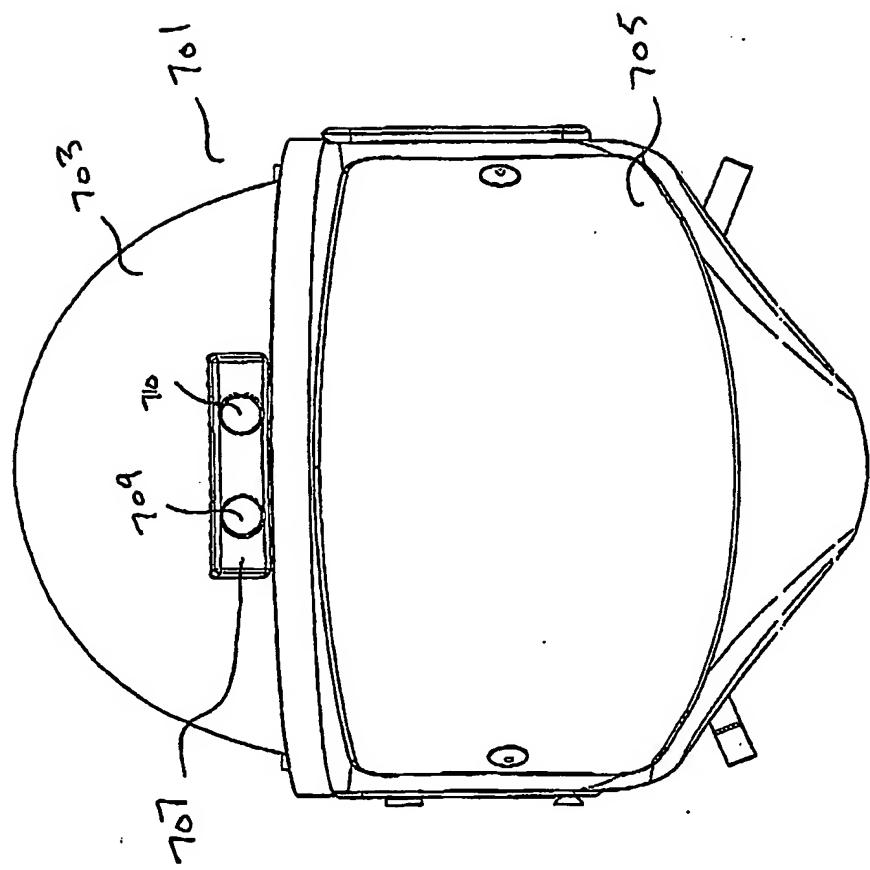
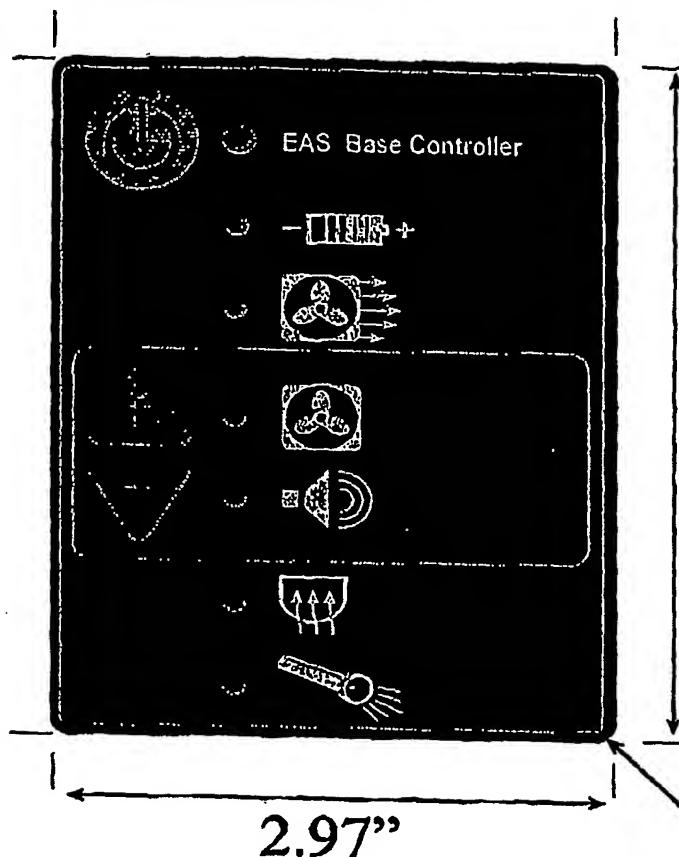


Fig 26

Design Intent For EAS Base Controller Module Keypad Artwork



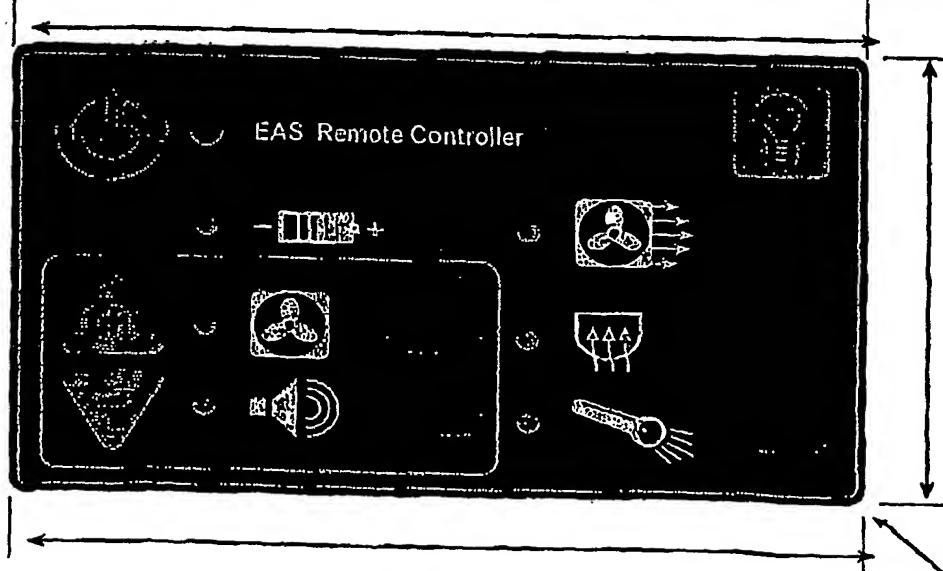
Jay Sobel
06 November 2003

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Fig 27A

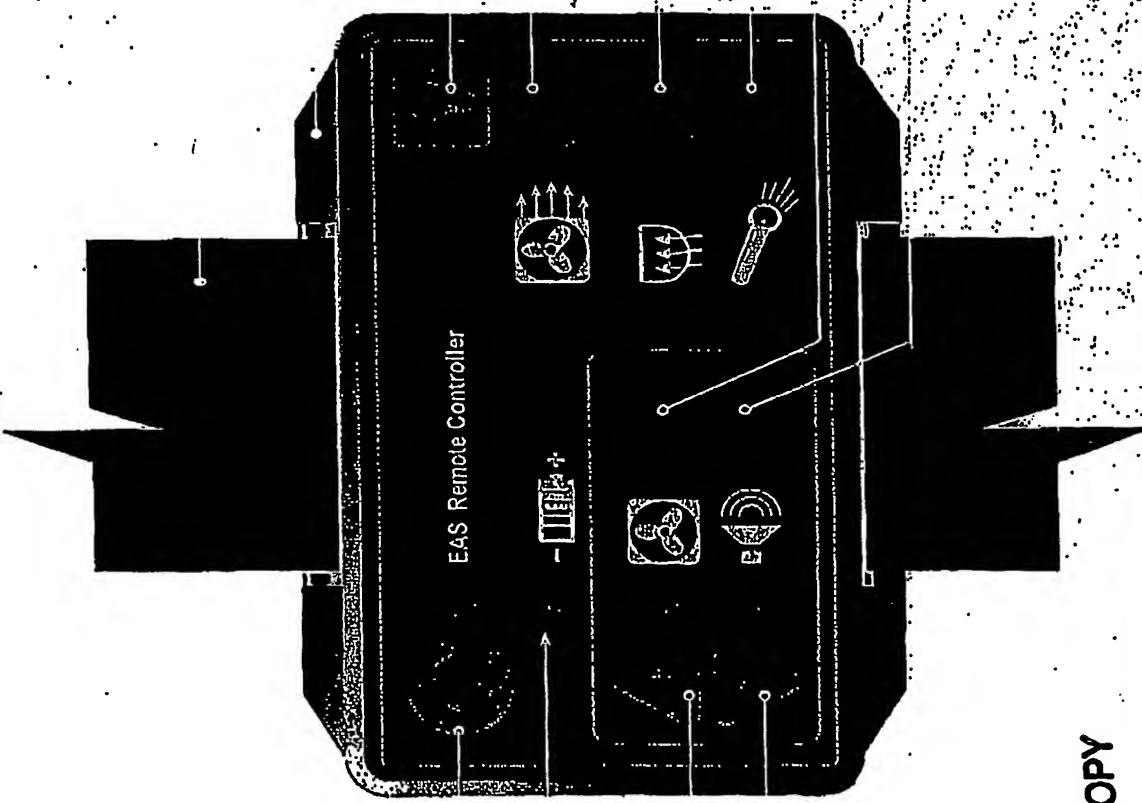
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TYP x 4 PLS.

Design Intent For EAS Remote Controller Module Keypad Artwork



R 0.100"
TYP x 4]

EOD-9 Helmet Project:
ELASTOMERIC Keypad for EAS REMOTE Controller Module
11 November 2003



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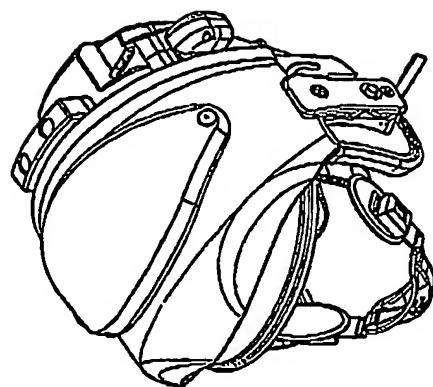
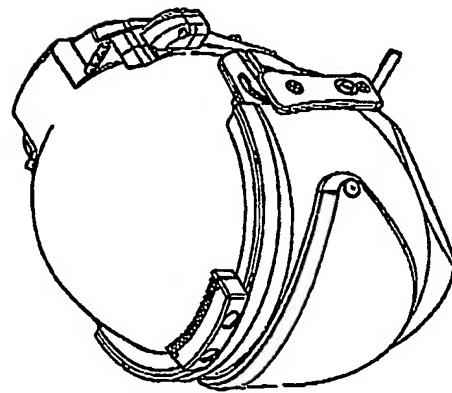
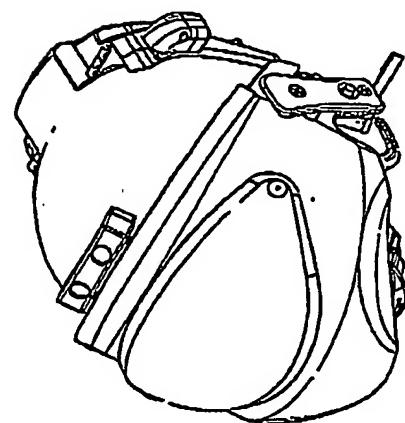


Fig 28



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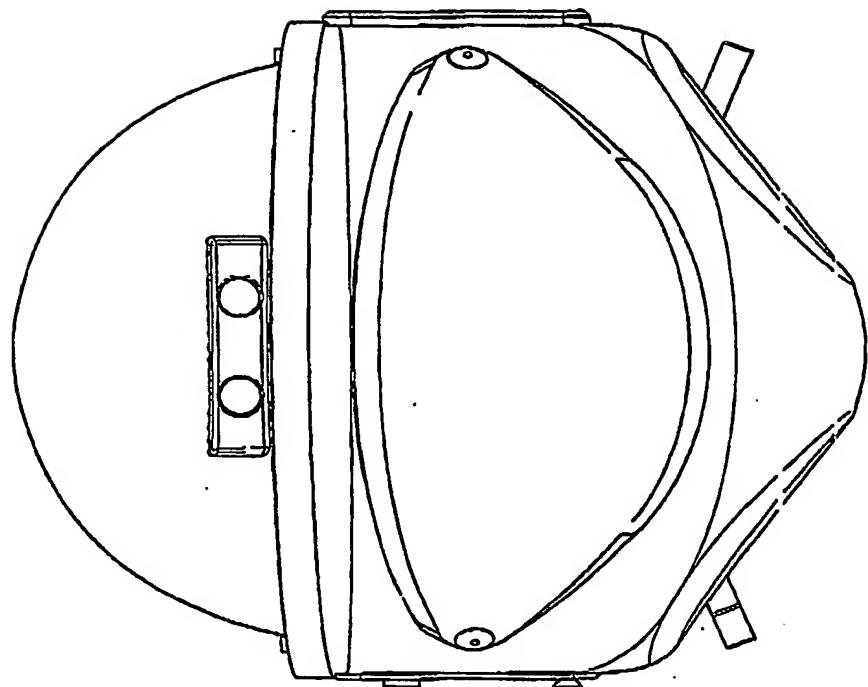
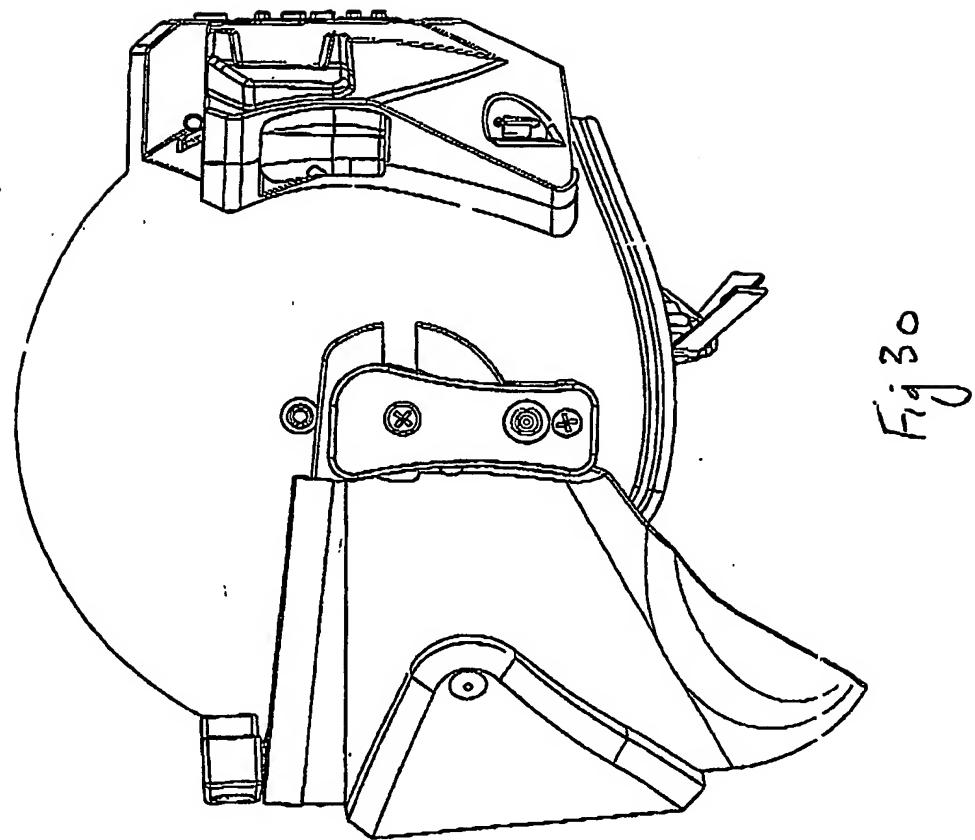
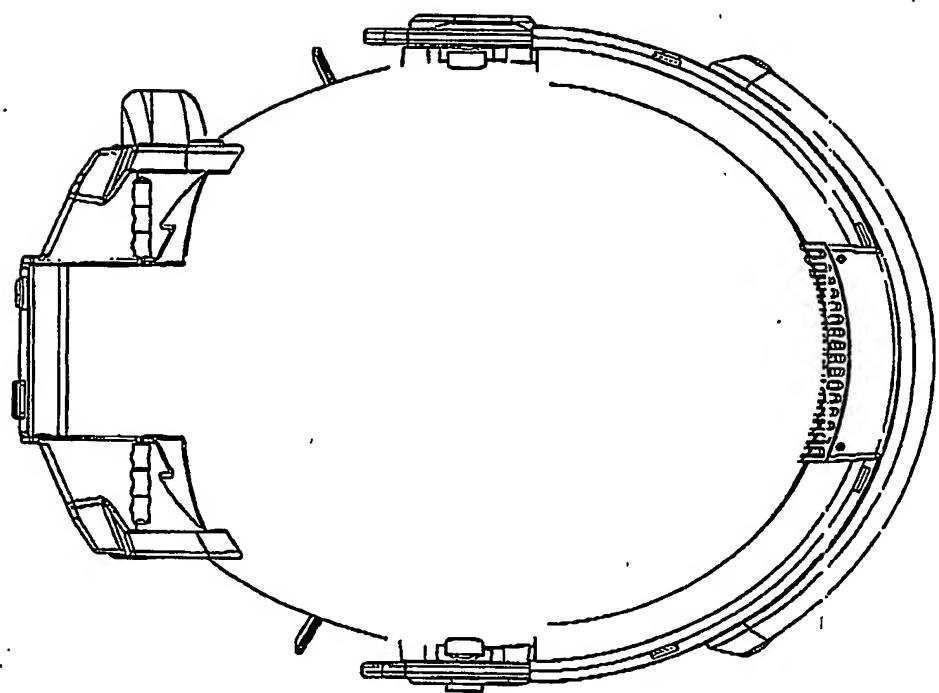


Fig 29

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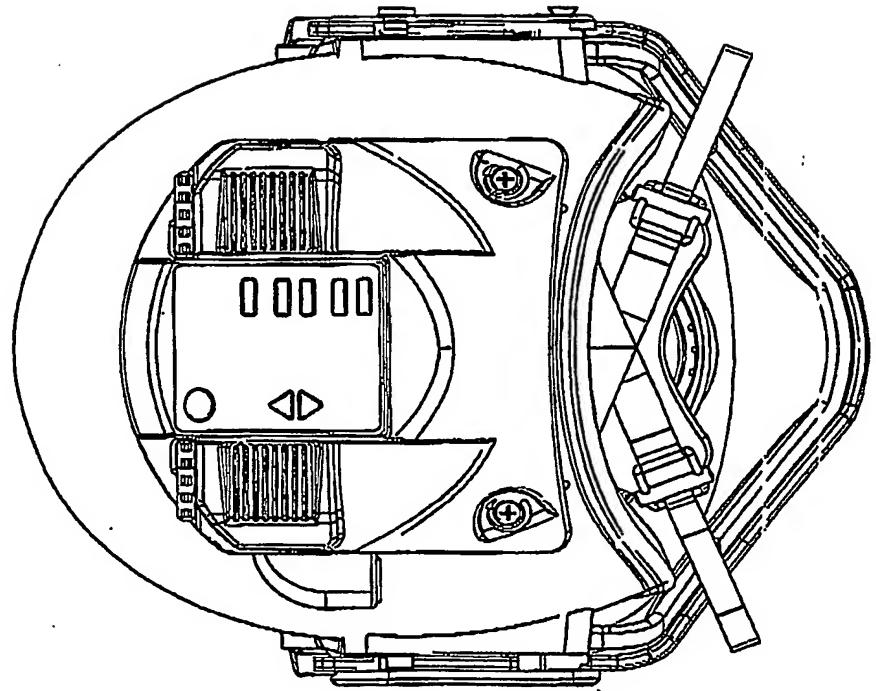
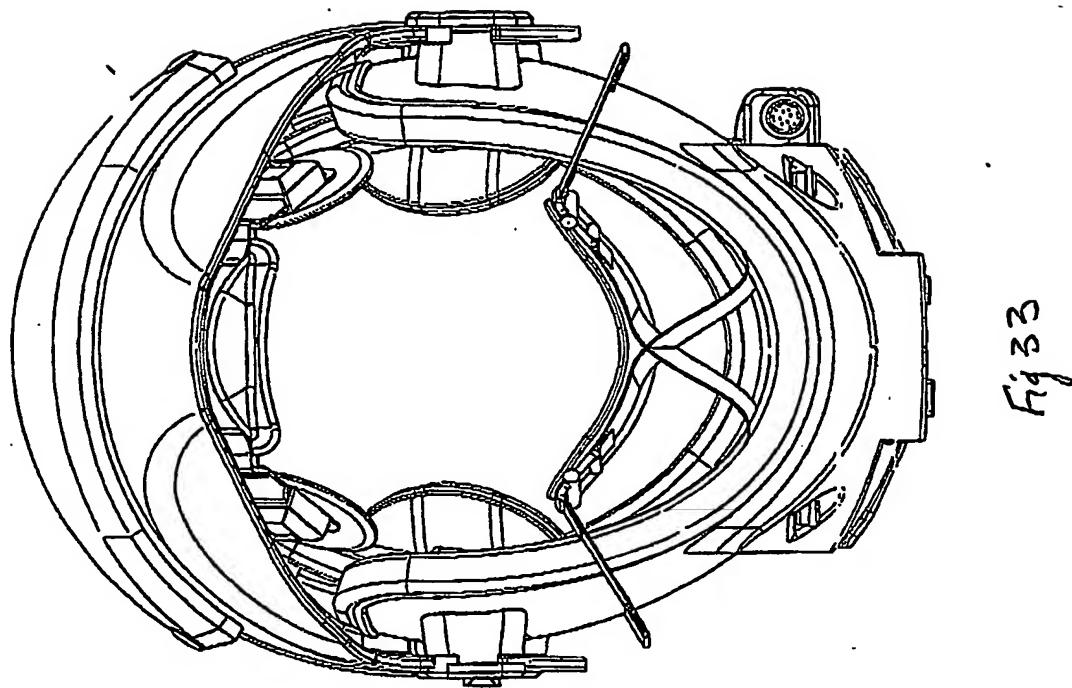


Fig 32

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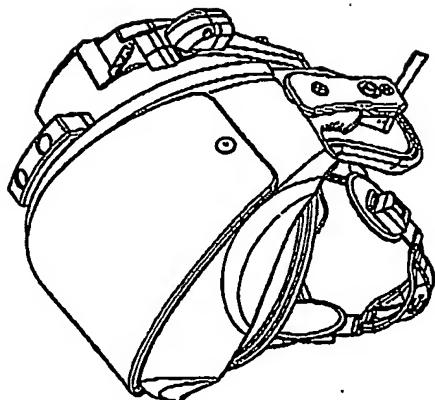
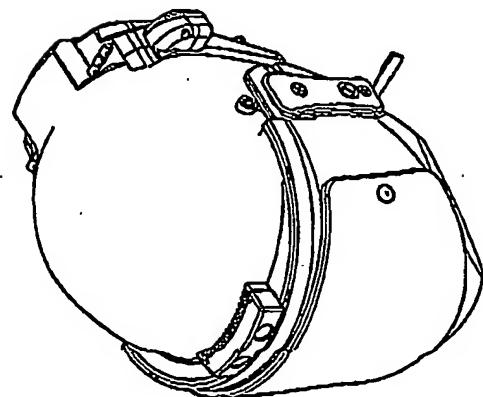
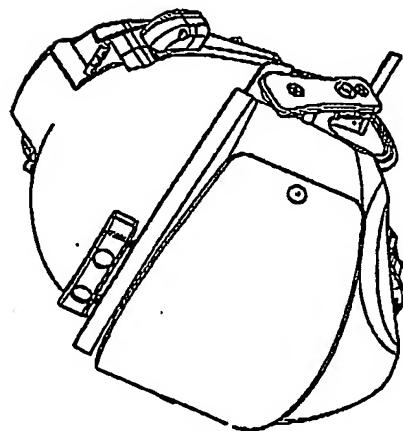


Fig 34



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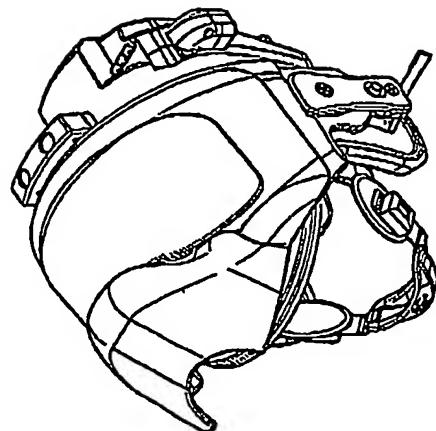
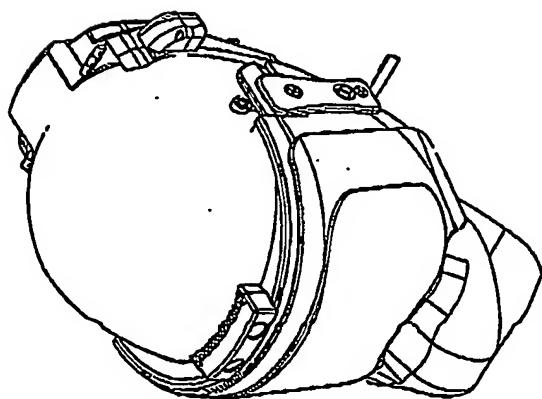
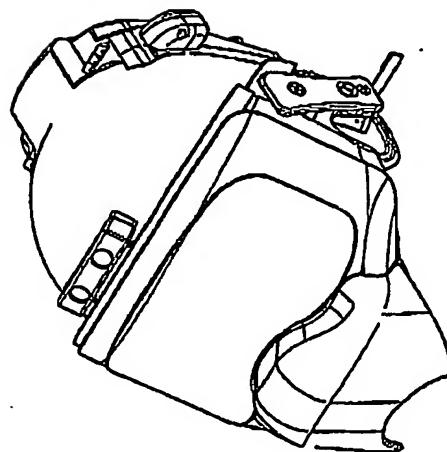
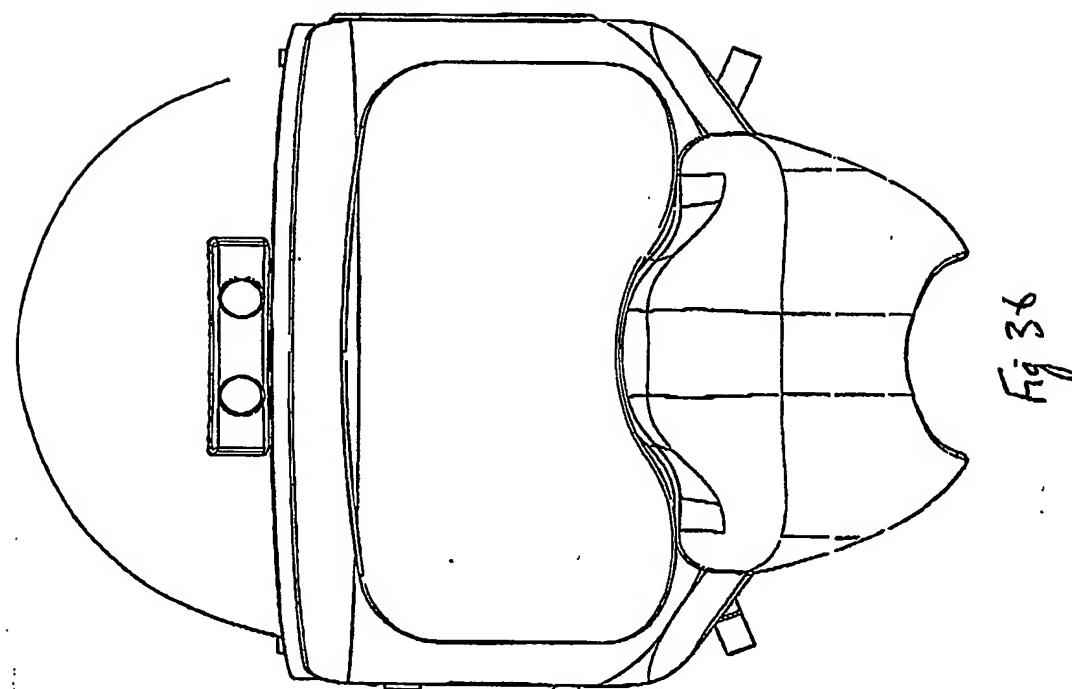


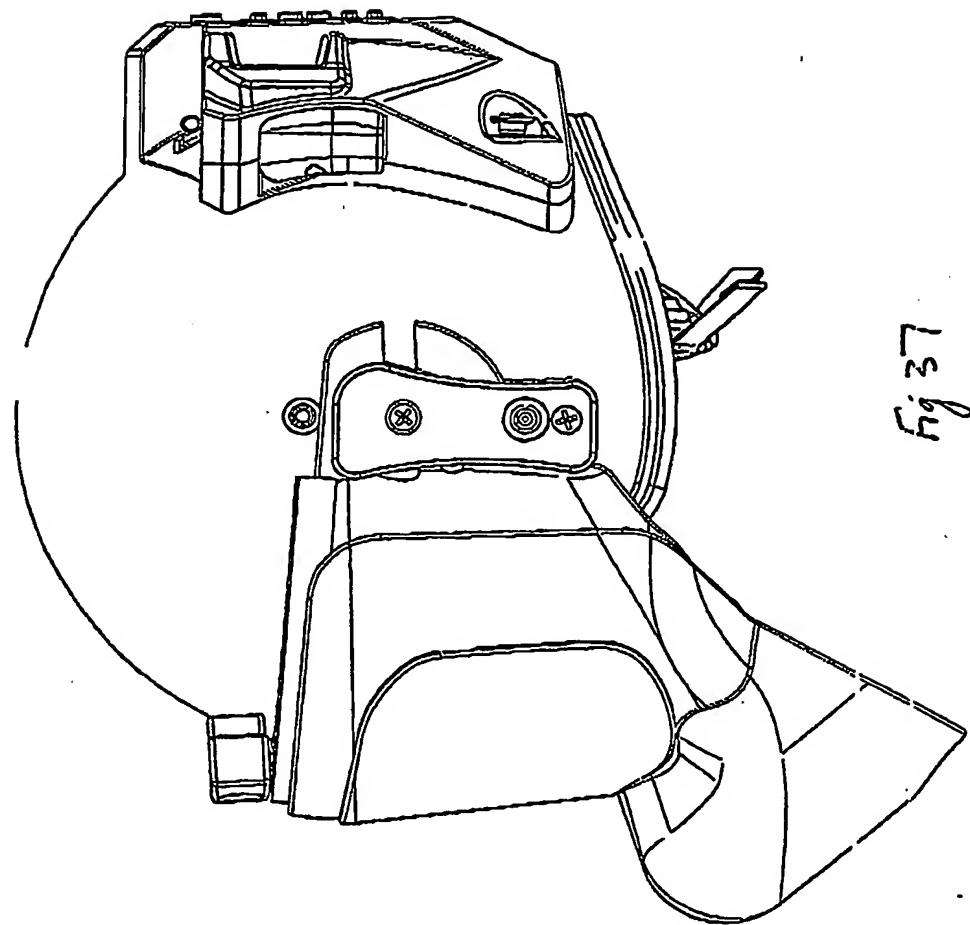
Fig 35



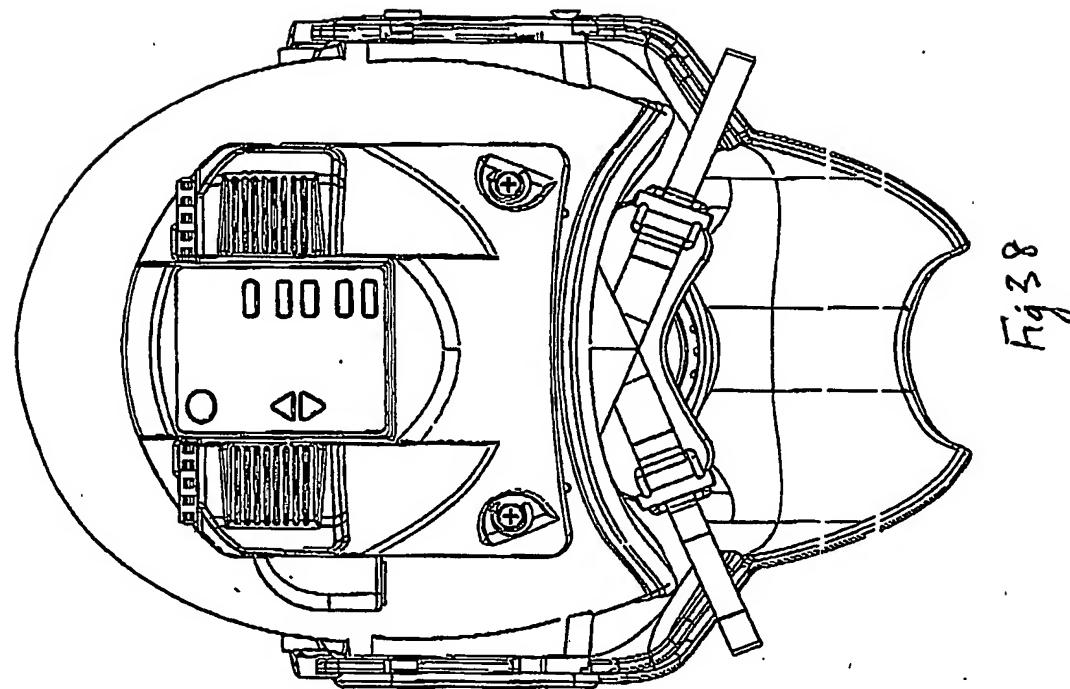
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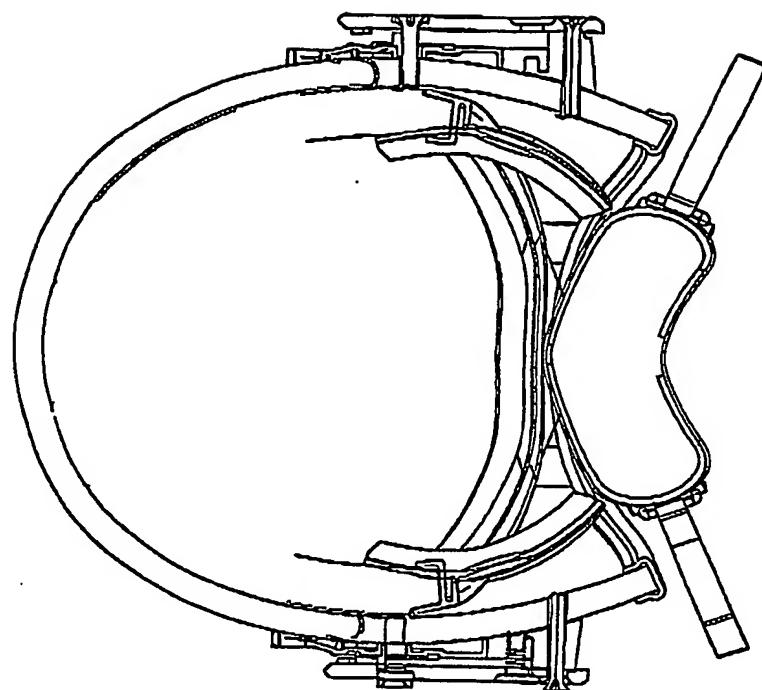


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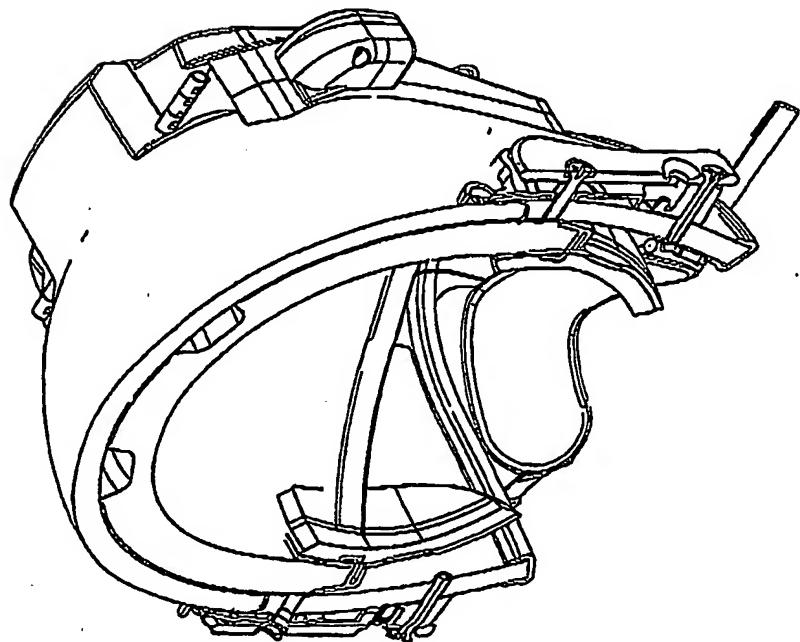
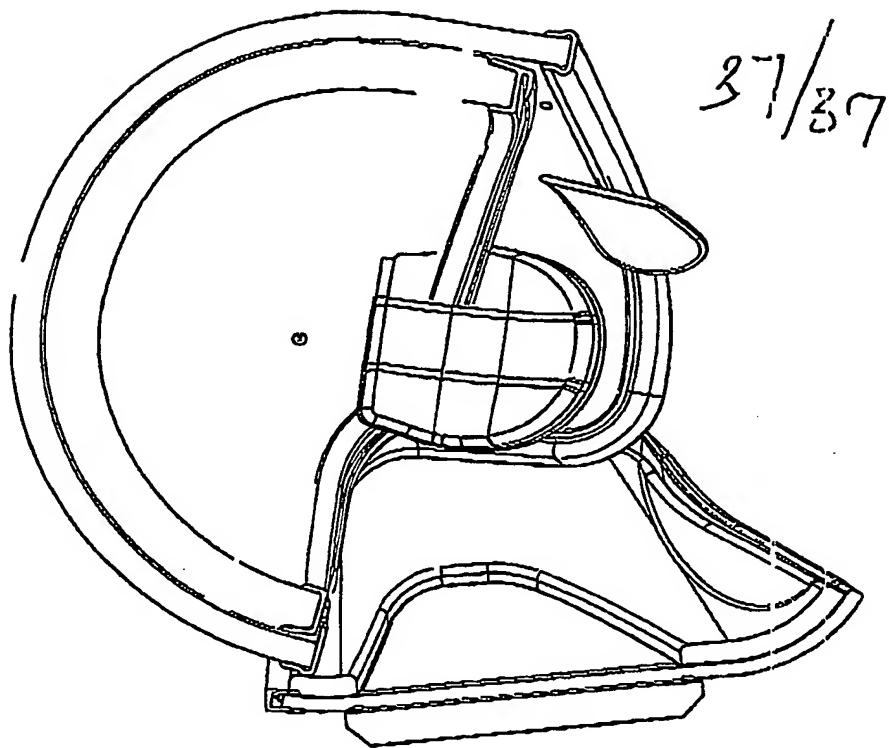
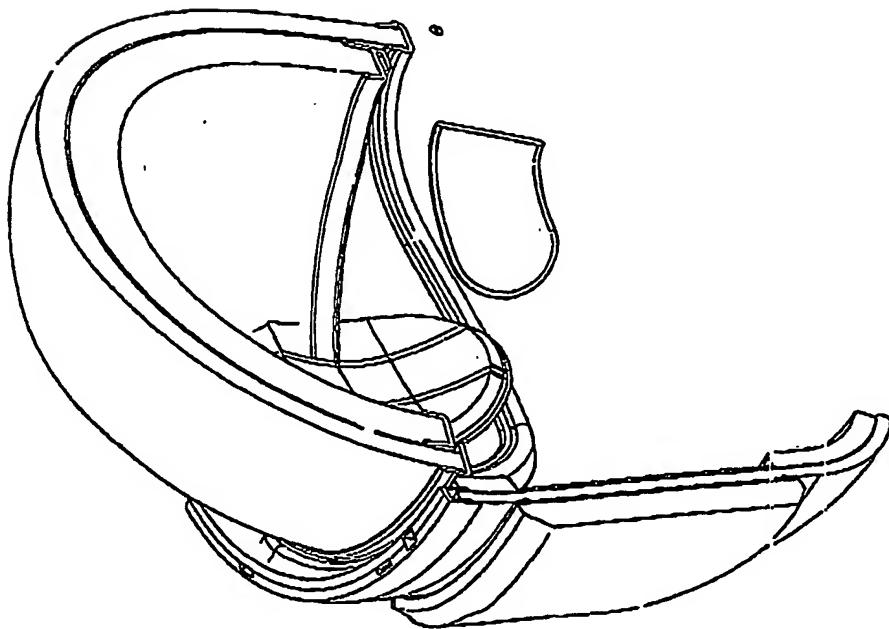


fig 39



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Fig 40



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